

NGM.COM • MAY 2010

NATIONAL GEOGRAPHIC

Mount St. Helens

NEW LIFE
IN THE BLAST ZONE

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2010 Toyota RAV4 4x2

MPG: 28 - EPA est hwy

Hwy Driving Range: 445 miles

Five-Star Crash Safety Rating: no*

Powertrain Warranty: 5 years/60,000 miles**

A Consumers Digest Best Buy: no

Automatic Crash Response: not available

Link to Emergency Services: not available

*Government star ratings are part of the National Highway Traffic Safety Administration's (NHTSA's) New Car Assessment Program (www.safercar.gov).

**Whichever comes first. See dealer for limited warranty details.

†Visit onstar.com for details and system limitations.



2010 Chevy Equinox FWD

MPG: 32 – EPA est hwy

Hwy Driving Range: 600 miles

Five-Star Crash Safety Rating: yes*

Powertrain Warranty: 5 years/100,000 miles**

A Consumers Digest Best Buy: yes

Automatic Crash Response: OnStar®/1 year standard†

Link to Emergency Services: OnStar/1 year standard



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Bogota Rail (*Rallus semiplumbeus*)

Size: Head and body length, 25 - 30 cm (9.8 - 11.8 inches) **Weight:** 75 - 90 g (2.6 - 3.2 oz)

Habitat: A small number of wetland and savanna areas of the Ubaté-Bogotá plateau, near Laguna de Tota, and some of the surrounding higher-altitude areas **Surviving number:** Estimated at 1,000 - 2,500



Photographed by Murray Cooper

WILDLIFE AS CANON SEES IT

A world of water. Lakes and marsh wetlands are the ideal home for the Bogota rail, whose diet consists largely of aquatic invertebrates and insect larvae. This water-rich landscape is where it builds its elbow-shaped globular nests. And this is where monogamous couples put down roots and care for their chicks. The territorial bird will do what it can to defend its turf, but it is powerless to fight the immense habitat loss these precious wetlands have suffered.

Drainage, pollution, untreated sewage and siltation have all compromised vital lakes and wetlands, and predation by feral dogs adds to the bird's plight. Right now, the rail is in a world of trouble.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.

NATIONAL GEOGRAPHIC

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- Shocking New Saints** **54** They're adored by Mexican outlaws and ordinary folks.
By Alma Guillermoprieto Photographs by Shaul Schwarz
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By D. T. Max Photographs by Maggie Steber
- China's Tea Horse Road** **94** Remnants of the legendary trail lead to modern thrills.
By Mark Jenkins Photographs by Michael Yamashita
- Europe's Wild Side** **120** A team of photographers captures rebounding wildlife.
- Lifeline for the Lynx** **134** Spanish conservationists care for the world's rarest cat.
Photographs by Pete Oxford and Reneé Bish



MAGGIE STEBER

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Massive *Nephila* spin golden orbs that are more than three feet across.

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Scanning Life 30

There's a new tool to study biodiversity: a bit of DNA that acts as a bar code.

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On the Cover

When: May 18, 1980, about an hour after Mount St. Helens's 8:32 a.m. eruption.

Where: in a plane three-quarters of a mile from the volcano's south side.

Photo by Roger Werth, Daily News

ngm.com



▲ A Blast From the Past

Revisit our coverage of the Mount St. Helens eruption, with photos, graphics, and a story called "Mountain With a Death Wish." The writer's first line: "First I must tell you that I count it no small wonder to be alive."

STEVE RAYMER, NATIONAL GEOGRAPHIC STOCK

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EDITOR'S NOTE



Retired logger Ralph Killian searched in May 1981 for his son, lost after the eruption of Mount St. Helens.

In 1981, nearly a year after the eruption of Mount St. Helens in Washington State, I flew over a monochromatic landscape littered with the shattered trunks of old-growth firs. Before the deadly event that killed 57 people, this had been one of the most beautiful mountains in the Cascades. Afterward, it was a gaping hole breathing plumes of steam.

A colleague from the *Seattle Times* and I were looking for Ralph Killian, a man on a mission. We spotted him, digging in a tangle of trees (above). He had the weathered look of someone who had spent most of his 61 years working the timberland of the Pacific Northwest. Over the past year Ralph had been searching for the remains of his son, John, and daughter-in-law, Christy, who had been camping in the area at the time of the eruption.

"A lot of people would just try to forget about it," he said when we landed to interview him. "We go on living. Have to. But we can't just forget that easy. I've got to know what happened." Ralph had accepted the deaths of his loved ones long ago. But he still wanted to fill in the details of that day. In a bittersweet ending, he did recover his daughter-in-law's remains though not those of his son.

Science helps us understand many things: We can track a hurricane and measure a tsunami's wall of water. But some things are beyond the dissecting lens of science. An aching heart, for one.

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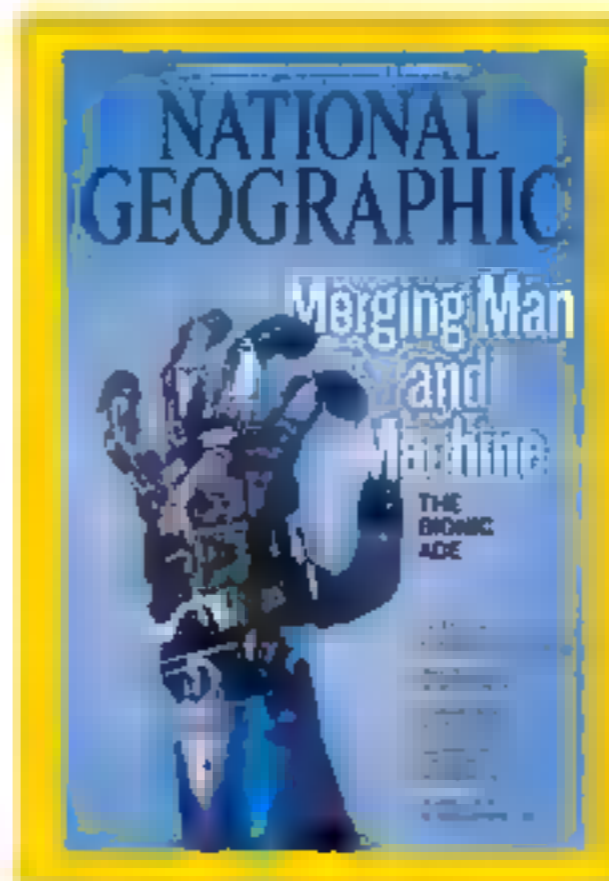
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LETTERS



January 2010

Asia's Wildlife Trade

I was surprised to find that the United States is the largest importer of legally trafficked animals and animal parts. The article's title should have been "The United States' Wildlife Trade." Without demand, the efforts to supply it would cease to exist. The whole idea of this activity is disgusting. The U.S. should be doing more to stop this trade.

GEOFF RICHARDSON
Stow, Ohio

All of the reptiles that I have seen in pet shops over the years that are new or uncommon in the reptile trade were wild caught. Their weatherworn look gave them away. Once I saw a Mali *Uromastix* come in with a new shipment of [captive-bred] baby bearded dragons, and the poor thing lasted a little more than a week before it died. Another time a mountain horned dragon contracted ■ skin parasite (probably from its wild habitat) and its "horns" fell off the first few days in the pet shop. Luckily my friend adopted it and took it to a vet. I feel sorry for the first-time reptile owners who buy ■ seemingly healthy reptile only to come back with a dead reptile a few days later. The reptiles are always called captive bred and vet quality at my local pet store, so they are usually expensive. Sadly, there are people who buy these actually wild-caught animals. Thank you for letting people know about this.

HANNAH PHYKITT
Charlotte, North Carolina

Since the official opening of Penang Bird Park in 1988, I have received the same advice from visitors, friends, strangers, wildlife traders, and wildlife hobbyists: Stay away from Anson Wong. As such, Penang Bird Park and I have never had any social or business association with Anson Wong. I repeat: I am not associated with Anson Wong in any sense.

GINO OOI HONG CHIN
 Director, Penang Bird Park
 Penang, Malaysia

The Singapore Solution

The article smacks of mocking. Caning as a punishment for vandalism? At least the laws in Singapore are fair for both citizens and foreigners. We do not have one law for Singapore and one for Abu Ghraib. Our

forefathers knew oppression, and that was when the Union Jack flew on our shores. Being mentioned in the same breath as Robert Mugabe and Fidel Castro surely did not endear Lee Kuan Yew's Singapore Model to your uninformed readers. But the Singapore Model helped contain SARS, created traffic systems imitated by New York City and London, afforded health care to all, educated all our children, and defended our way of life. If we want to taste the sweetness of freedom, it is but a short flight away to any global city, where we have to be careful not to venture out at night, marvel at the income gap between Wall Street and Main Street, and yes, get gum stuck on the bottom of our shoes. Singapore is imperfect,

but we make do with what we have. There is much we are unhappy with, but against the backdrop of a malarial swamp, we have much to be thankful for.

CHOON-HOU HO
 Singapore

Corrections, Clarifications

January 2010: Asia's Wildlife Trade
 Page 91: The ceremonial robe shown is trimmed with skin from a leopard, not a snow leopard.

April 2010: Table of Contents
 A small portion of our press run contained an error in the spelling of Howard G. Buffett's name. We sincerely regret the error.

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EDITORS' CHOICE

Estan Cabigas Talisay City, Philippines

On Good Friday in the Philippine town of Infanta, this Roman Catholic flagellant donned a floral headdress called ■ *tukarol*. Cabigas, 36, captured his image while documenting Holy Week practices for a school assignment.

Samuel Blanc Grenoble, France

A polar guide, Blanc, 31, was leading ■ boat tour through the Svalbard archipelago between Norway and the North Pole when he saw this scene. "Bråsvellbreen is one of my favorite glaciers," he explains, "due to the huge waterfalls."



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VISIONS OF EARTH



India Silhouetted in the Andaman Sea, a 60-year-old elephant named Rajan—here with his handler, Nasru—takes a morning dip in the warm waters. The now retired pachyderm hauled timber in the Andaman Islands for 30 years.

PHOTO: CESARE NALDI



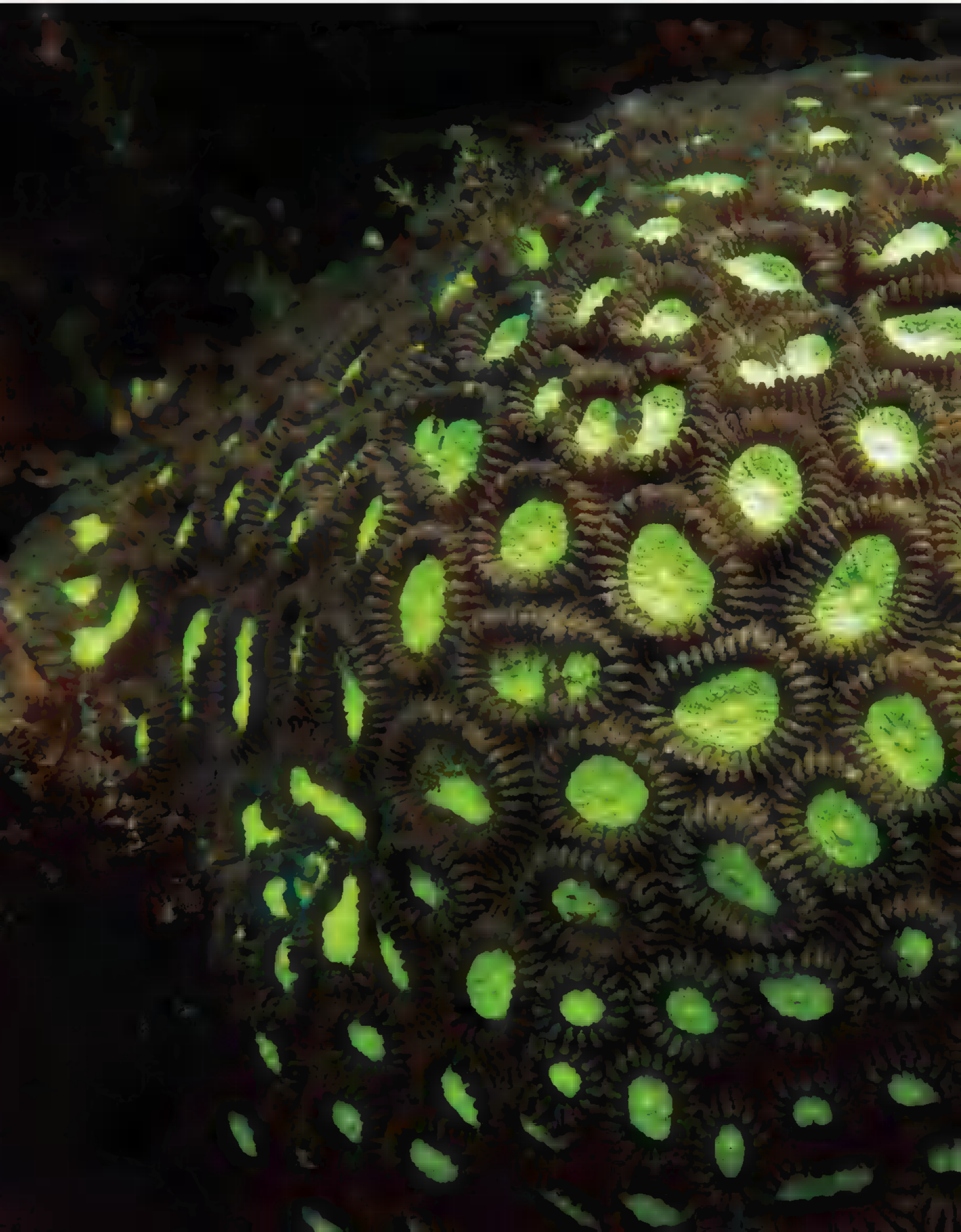
China Vehicles form a line for natural gas on a spiral bridge in Chongqing. Supplies of the fuel were diverted to snowed-in northern China last November, sparking a shortage in the central and eastern provinces.



PHOTO: WEN RAN, REUTERS

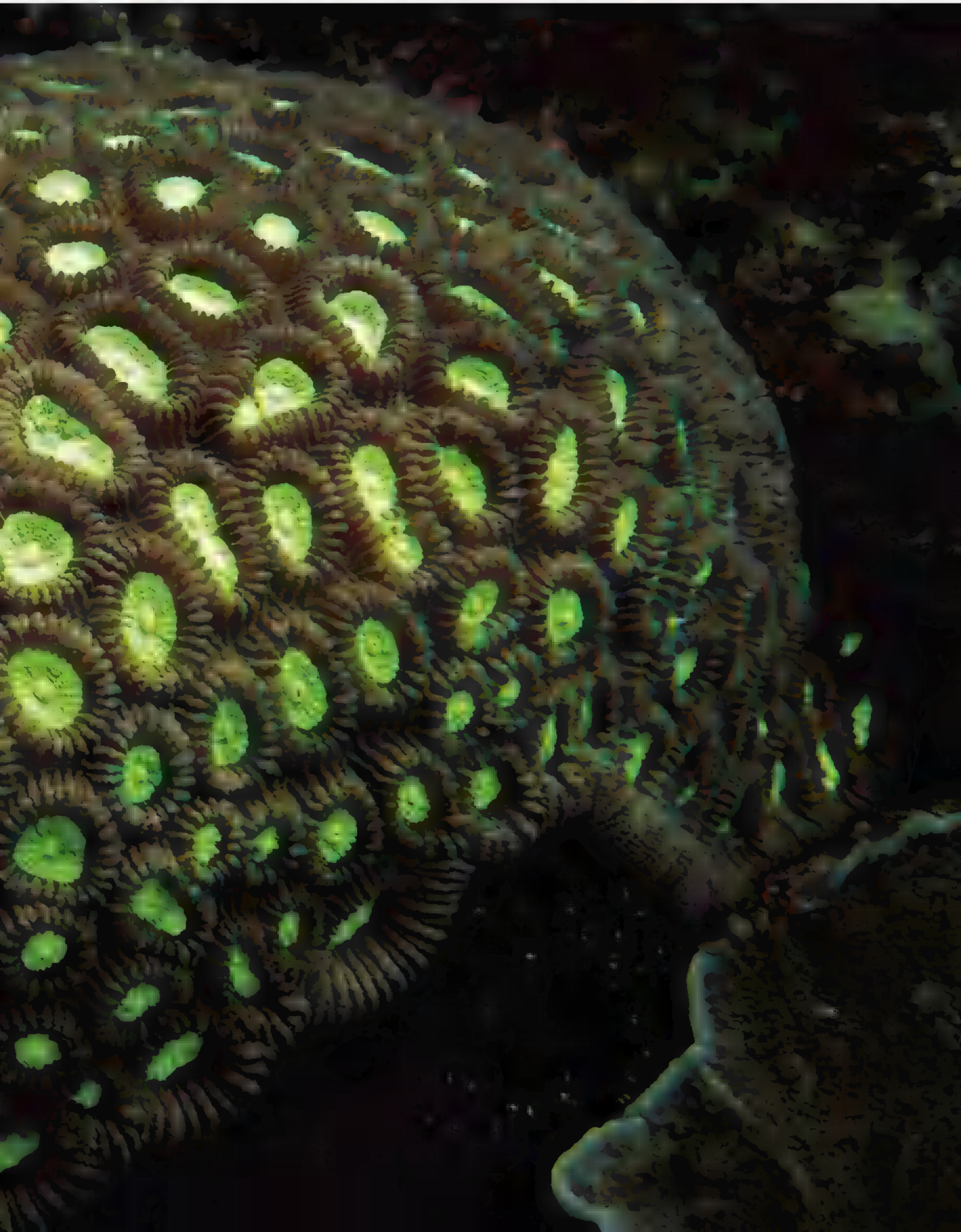


Indonesia In waters off the Raja Ampat Islands, a honeycomb coral glows green. The archipelago is a hot spot of coral diversity—some 75 percent of all known coral species can be found there.



Order prints of *National Geographic* photos online at [PrintsNGS.com](https://www.printsngs.com).

PHOTO: MARK PICKFORD





Support the Future

"We believe in the work of National Geographic and wanted to be involved," says John Spinelli. He and his wife Shirley grew up reading *National Geographic* magazine and passed that love on to their children and grandchildren. Now retired, they enjoy in-line skating, tennis and bird watching.

The Spinellis set up a charitable gift annuity which provides them with steady income and tax savings while supporting the Society's efforts worldwide. "National Geographic is an important source for solutions to the challenges facing our planet," says John. "We want the world to be in good shape for our grandchildren."

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Sample Annuity Rates for One Beneficiary

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John: Joseph van Haelewyn

John and Shirley Spinelli included National Geographic in their estate plans.



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of

It's not the advice you'd expect. Learning a new language seems formidable, as we recall from years of combat with grammar and translations in school. Yet infants begin at birth. They communicate at eighteen months and speak the language fluently before they go to school. And they never battle translations or grammar explanations along the way.

Born into a veritable language jamboree, children figure out language purely from the sounds, objects and interactions around them.

Their senses fire up neural circuits that send the stimuli to different language areas in the brain. Meanings fuse to words. Words string into structures. And language erupts.

Three characteristics of the child's language-learning process are crucial for success:

First, and most importantly, a child's natural language-learning ability emerges only in a speech-soaked, immersion environment free of translations and explanations of grammar.

Second, a child's language learning is dramatically accelerated by constant feedback from family and friends. Positive correction and persistent reinforcement nurture the child's language and language skills into full communicative expression.

Third, children learn through play, whether it's the arm-waving balancing act that announces their first step or the spluttering preamble to their first words. All the conversational chatter skittering through young children's play with parents and playmates—"...what's this..." "...clap, clap your hands..." "...my ball..."—helps children develop language skills that connect them to the world.

Adults possess this same powerful language-learning ability that orchestrated our language success as children. Sadly, our clashes with vocabulary drills and grammar explanations force us to conclude it's hopeless. We simply don't have "the language learning gene."

At Rosetta Stone, we know otherwise. You can recover your native language-learning ability as an adult by prompting your brain to learn language the way it's wired to learn language:

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ARCHAEOLOGY

Fit for a King Wielding his metal detector in a plowed field in Staffordshire, England, last summer, amateur treasure hunter Terry Herbert hit an astonishing jackpot—more than 1,600 Anglo-Saxon objects of gold and silver from about A.D. 650. The largest such hoard ever found, it is composed mainly of fittings from hilts of swords—but also includes parts of

at least one helmet, three crosses, and a band that bears a Latin inscription from the Bible. With many pieces displaying intricate designs and some inlaid with patterns of garnets, the exquisitely worked collection likely belonged to a ruler of Mercia, one of the warring kingdoms of the period.

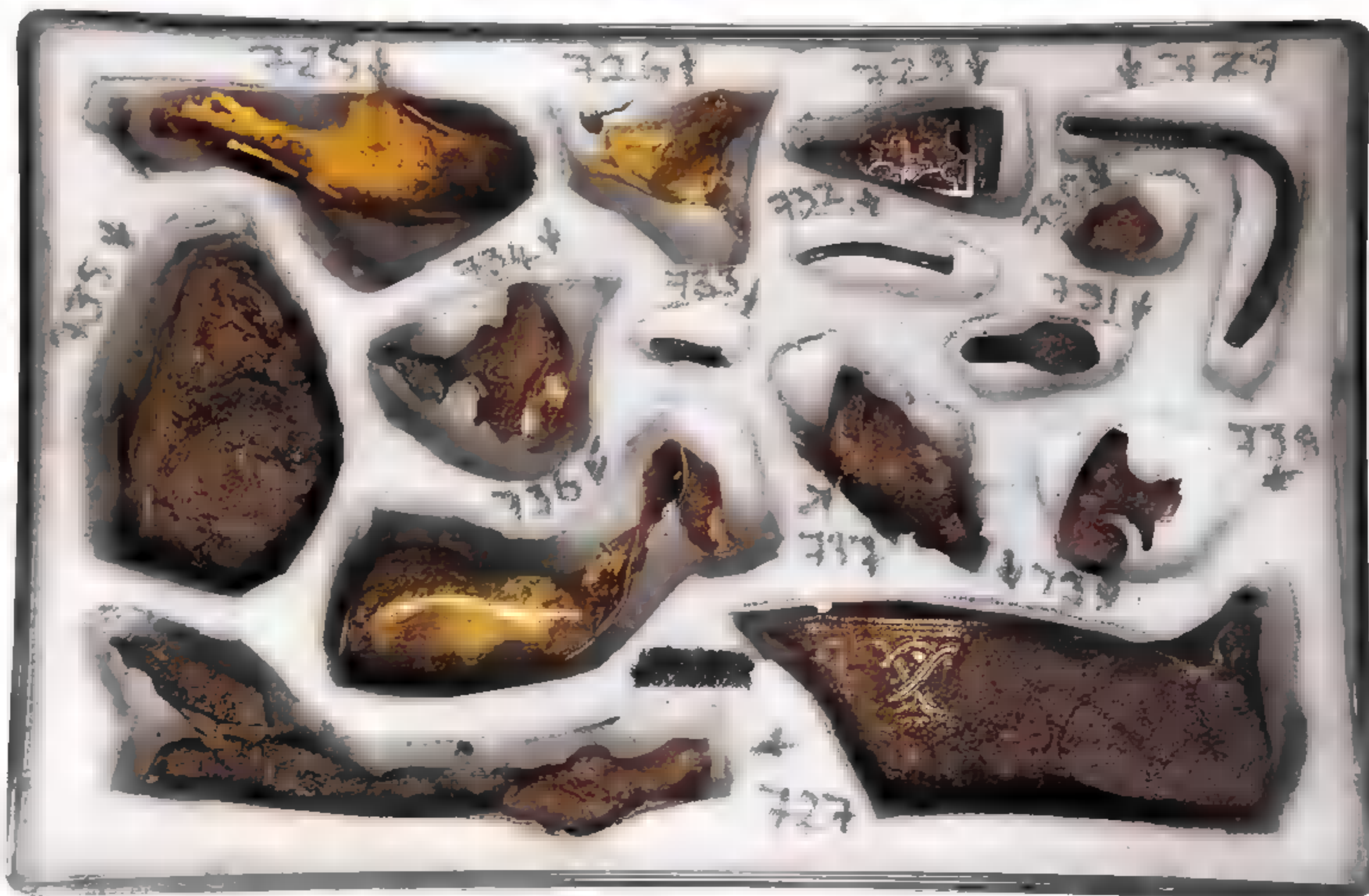
Why the hoard was buried may remain a mystery. But as experts carry out their studies over the next few years, the treasure will offer valuable insights into

the art, wealth, power, and politics of the time as well as the region's transition from paganism to Christianity.

Meanwhile, local museums hope to raise \$5.3 million, the appraised value, to purchase the collection from the British crown. Terry Herbert and the owner of the field will each receive half—a fine reward for making history themselves. —A. R. Williams



A 1.6-inch-long figurine (above) and other relics (in protective foam, below) are among the treasures found.



PHOTOS: ROBERT CLARK, NGM MAPS

Watch *Lost Gold of the Dark Ages* on the National Geographic Channel, April 18 at 9 p.m.



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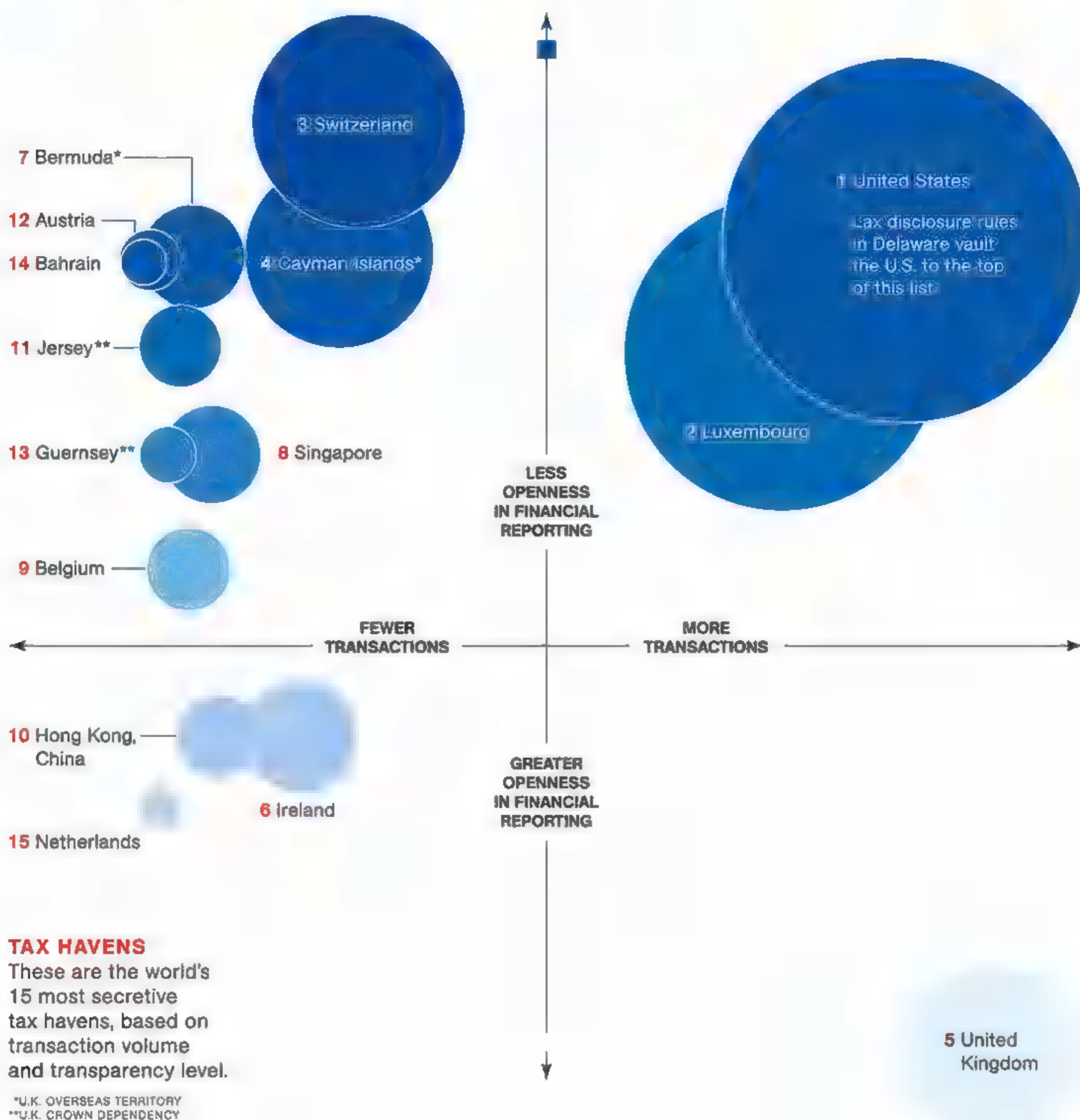
A jaw full of five-inch, knife-edged teeth let this newly unearthed ichthyosaur (above) tear into prey. The four-finned, 40-foot-long species swam in what's now Nevada.

NG GRANTEE **How the West Was Swum**

Nevada is covered in desert and ranks as the driest U.S. state. Yet 240 million years ago it was submerged under a vast ocean. A land animal turned marine reptile called the ichthyosaur—"fish lizard"—was so common there it's now the official state fossil. But serrated teeth nearly half a foot long on a specimen bigger than a killer whale? Unheard of—at least until recently.

University of Chicago paleontologist Nadia Fröbisch, who excavated the fossil in 2008 from the Augusta Mountains, thinks this top predator used its teeth to rip through the flesh and bones of defenseless fellow ichthyosaurs, many of which were smaller, and some of which had no teeth at all. No one knows how long this particular species ruled these waters, though the entire order died out around 90 million years ago, after a 160-million-year run. As Fröbisch explains, "They were a very successful group." —Hannah Bloch

GEOGRAPHY



Guarded Treasure Every year individuals and corporations transfer billions of pounds, euros, and dollars to 60 tax havens worldwide. These “secrecy jurisdictions” keep levies low or nonexistent and guard financial information, hiding trails a tax man might otherwise follow. Some free marketeers say havens improve banking competition and economic growth. Yet the U.S. Treasury loses an estimated \$100 billion a year to them. The biggest losers, says John Christensen of the Tax Justice Network, are the poor: A 2009 study found that developing countries forfeit up to a trillion dollars a year.

Last year governments in Europe and North America brokered information-exchange pacts with many havens. Christensen says that’s a start, but only full transparency—and bringing poor nations to the table too—will fix the problem. —Shelley Sperry

Places such as the U.S. and the U.K. do not rank this high on most lists of tax havens, which measure international transactions relative to GDP.

WILDLIFE

World's Widest Web Those stray strands in the corner of the spare room? Not the work of the spider genus *Nephila*, aka golden orb weavers. Their orbs—those familiar spirals with silken spokes—are the world's biggest, topping three feet across. And *Nephila* are the largest spiders that spin orb webs.

To add another superlative, researchers recently discovered the most imposing species of the widely dispersed genus, called *N. komaci* (right)—the first new *Nephila* in 130 years. The specimens on this page look ■ bit out of joint because Matjaž Kuntner of the Slovenian Academy of Sciences and Arts and Jonathan Coddington of the Smithsonian Institution discovered them, misclassified, in museum collections. Later, ■ colleague in South Africa found ■ few more crawling in the wild.

Female *N. komaci* have leg spans that exceed four inches, yet males (far right) are diminutive—a dramatic case of sexual dimorphism. Like other *Nephila*, these spiders spin tough, gold-colored webs. They usually snare insects, but, Coddington says, “they’d be happy eating a bird, bat, or lizard.” —Chris Carroll



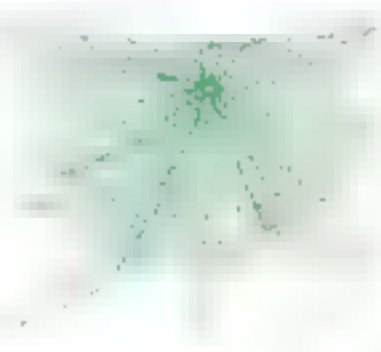
Silk Stages



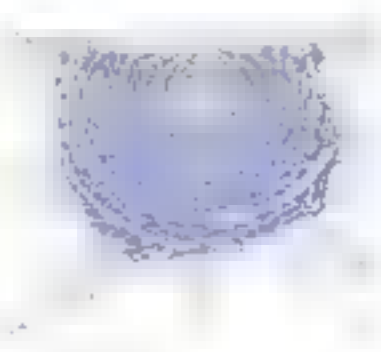
1 Outline



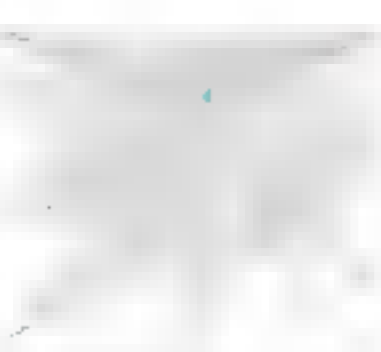
2 Radii



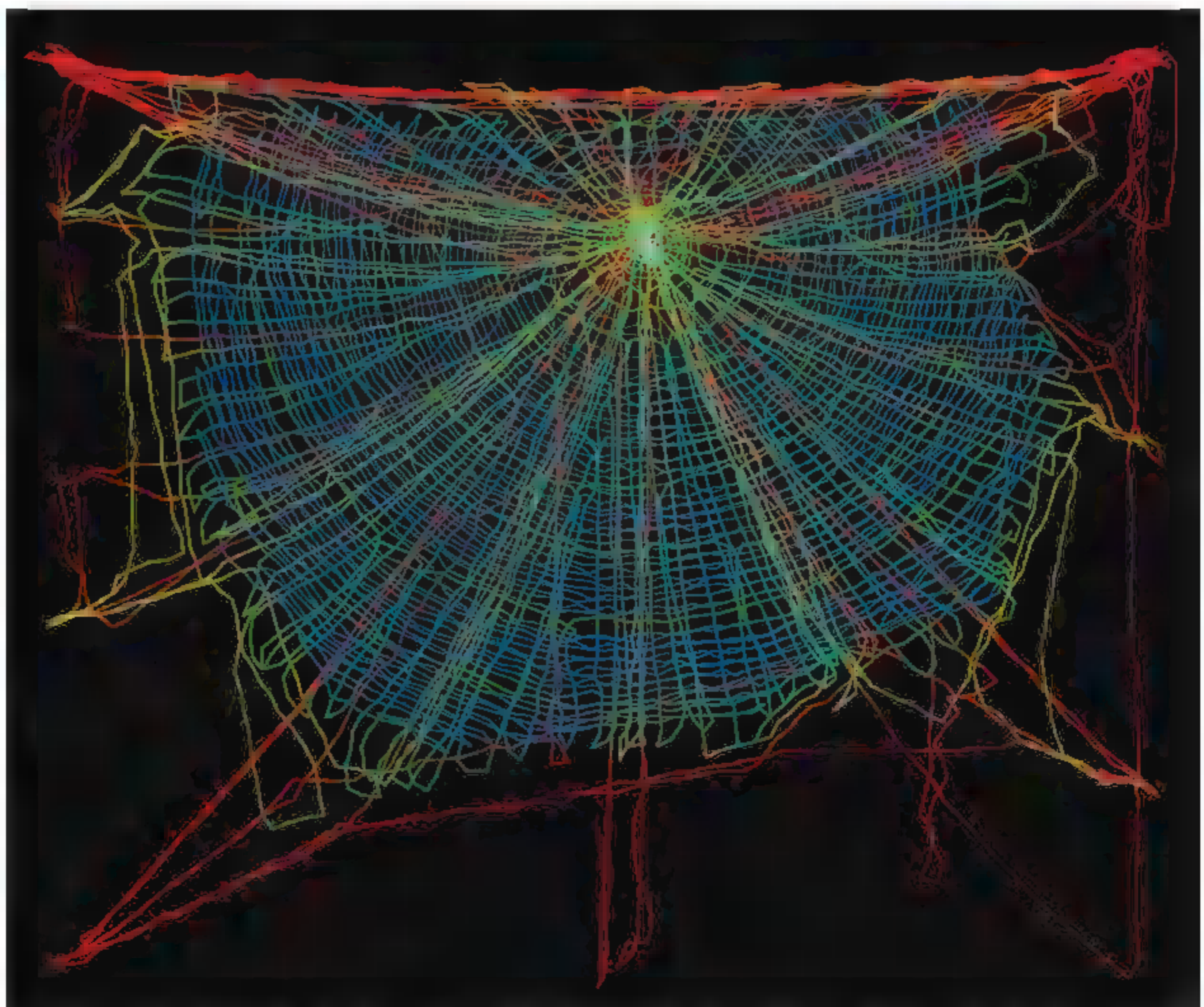
3 Auxiliary spiral



4 Sticky spiral



5 Hub



Nephila spiders first attach support threads, establishing an outline up to three feet across **1**, then unfurl radii **2** to hold an auxiliary spiral **3** that helps support the structure. A prey-snaring sticky spiral **4** is overlaid, followed by ■ nonsticky spot at the hub **5**, where the spider awaits a meal.



THE LAWS OF GRAVITY DON'T APPLY TO EUPHORIA.

*My leash is broken. Nothing can keep me down.
I can't find that kind of fun
There's an ex*



*...ect for me,
... beaten path with everything
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to other. Nature can't be put on a leash. There*

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Pop Cultures

Refrescos in Spanish, *mashroob ghazi* in Arabic, *kele* in Chinese: The world has many words, and an unslakable thirst, for carbonated soft drinks. Since 1997 per capita consumption has nearly doubled in eastern Europe. In 2008 Coca-Cola tallied soda sales in some 200 countries. Even the global recession, says industry monitor Zenith International, has merely caused manufacturers to lean on promotional offers and try cheap social-networking ads.

But some are sour on all this sweetness. U.S. obesity expert David Ludwig calls aggressive marketing in emerging nations—where people tend to eat more and move less as they prosper—“deeply irresponsible. That’s the time of greatest risk for heart disease, diabetes, and obesity.”

As that thinking catches on, places including New York and Romania are mulling levies on sugared drinks. Others argue that taxing a single product isn’t the fix; promoting healthy lifestyles and zero-calorie drinks is. Fizz for thought? —*Jeremy Berlin*

Consumption of carbonates* 12-ounce servings per person, 2008



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The 2010 Forum, themed Bridges to Sustainability: People, Planet, Possibility, will help all of us navigate the shoals of changing climate, changing energy supplies, changing habitat, and a changing planet. As our human family keeps growing—the population will reach seven billion sometime next year—the question “Can We Sustain This?” becomes more urgent. The stakes are high.

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We surf the Internet. We swim in magazines.

The Internet is exhilarating. Magazines are enveloping. The Internet grabs you. Magazines embrace you. The Internet is impulsive. Magazines are immersive. And both media are growing.

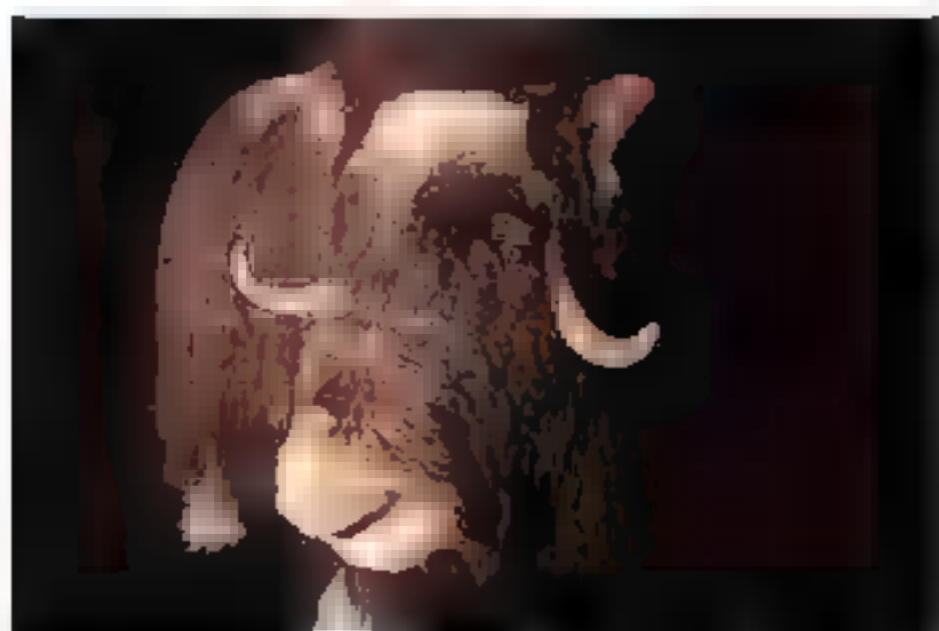
Barely noticed amidst the thunderous Internet clamor is the simple fact that magazine readership has risen over the past five years. Even in the age of the Internet, even among the groups one would assume are most singularly hooked on digital media, the appeal of magazines is growing.

Think of it this way: during the 12-year life of Google, magazine readership actually increased 11 percent.

What it proves, once again, is that a new medium doesn't necessarily displace an existing one. Just as movies didn't kill radio. Just as TV didn't kill movies. An established medium can continue to flourish so long as it continues to offer a unique experience. And, as reader loyalty and growth demonstrate, magazines do.

Which is why people aren't giving up swimming, just because they also enjoy surfing.

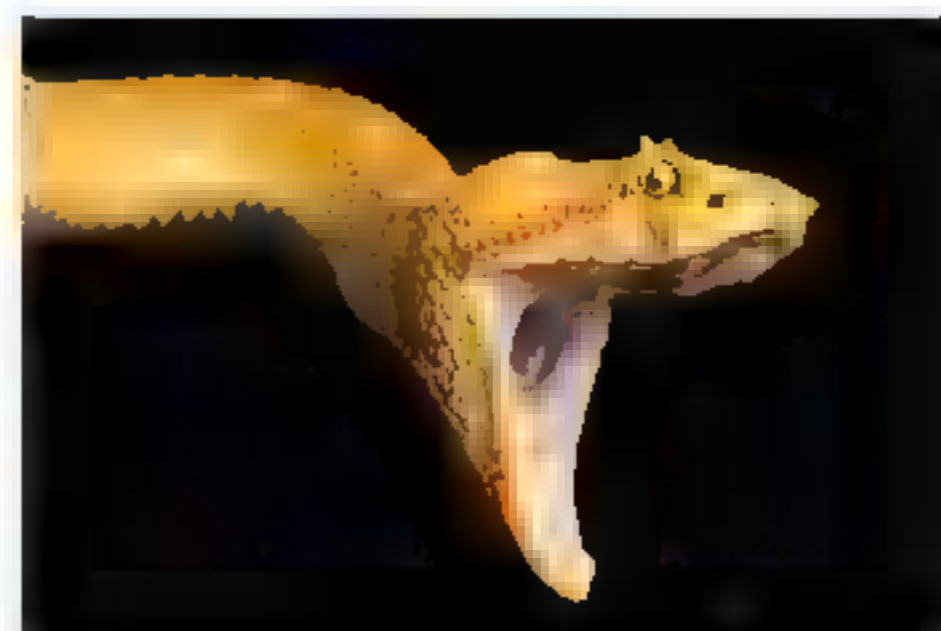
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MUSKOX (*OVIBOS MOSCHATUS*)



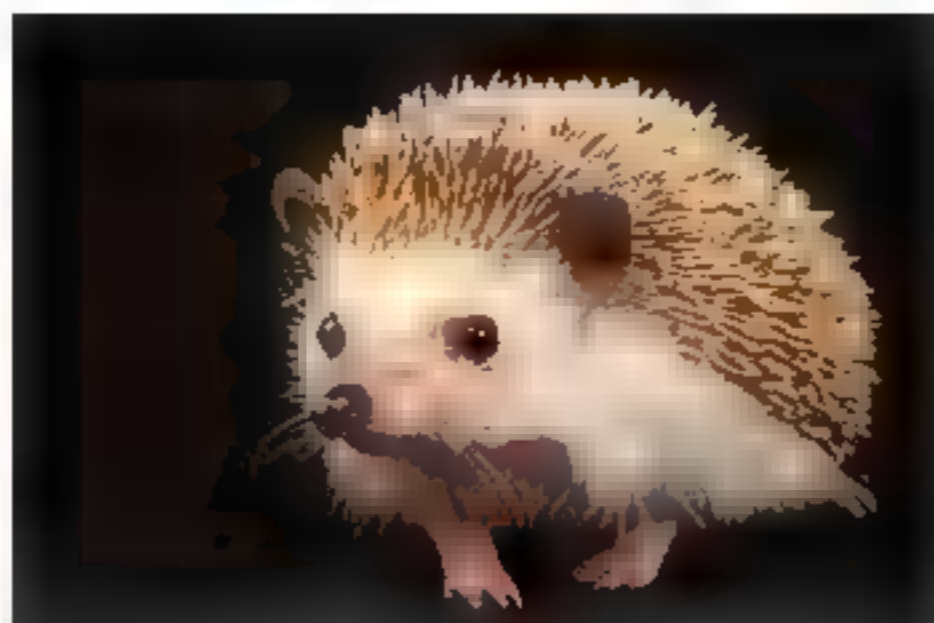
HERMIT CRAB (*COENOBITA SP.*)



EYELASH VIPER (*BOTHRIECHIS SCHLEGELII*)



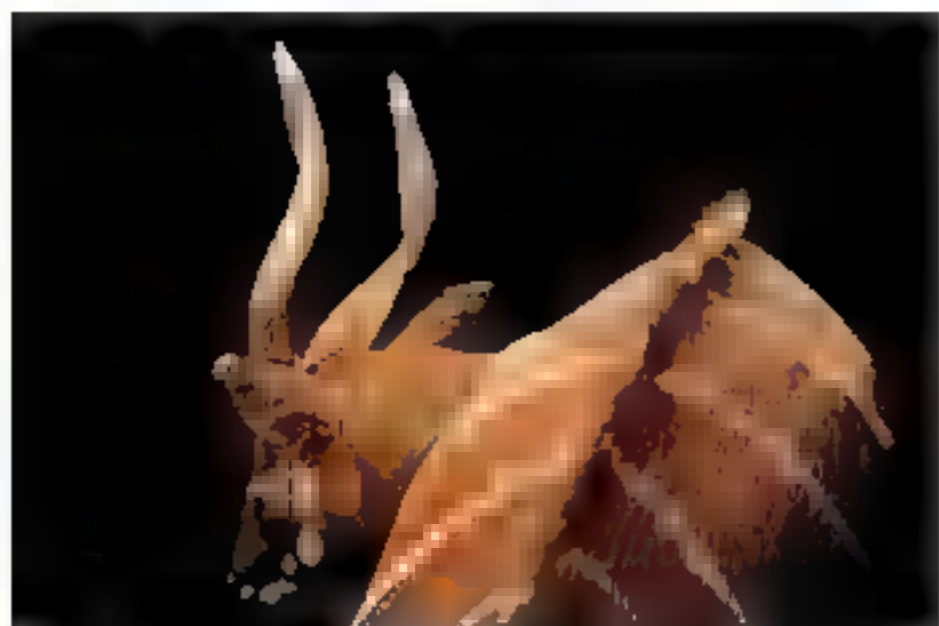
JUNGLE NYMPH WALKING STICK (*HETEROPTERYX DILATATA*)



AFRICAN PYGMY HEDGEHOG (*ATELERIX ALBIVENTRIS*)

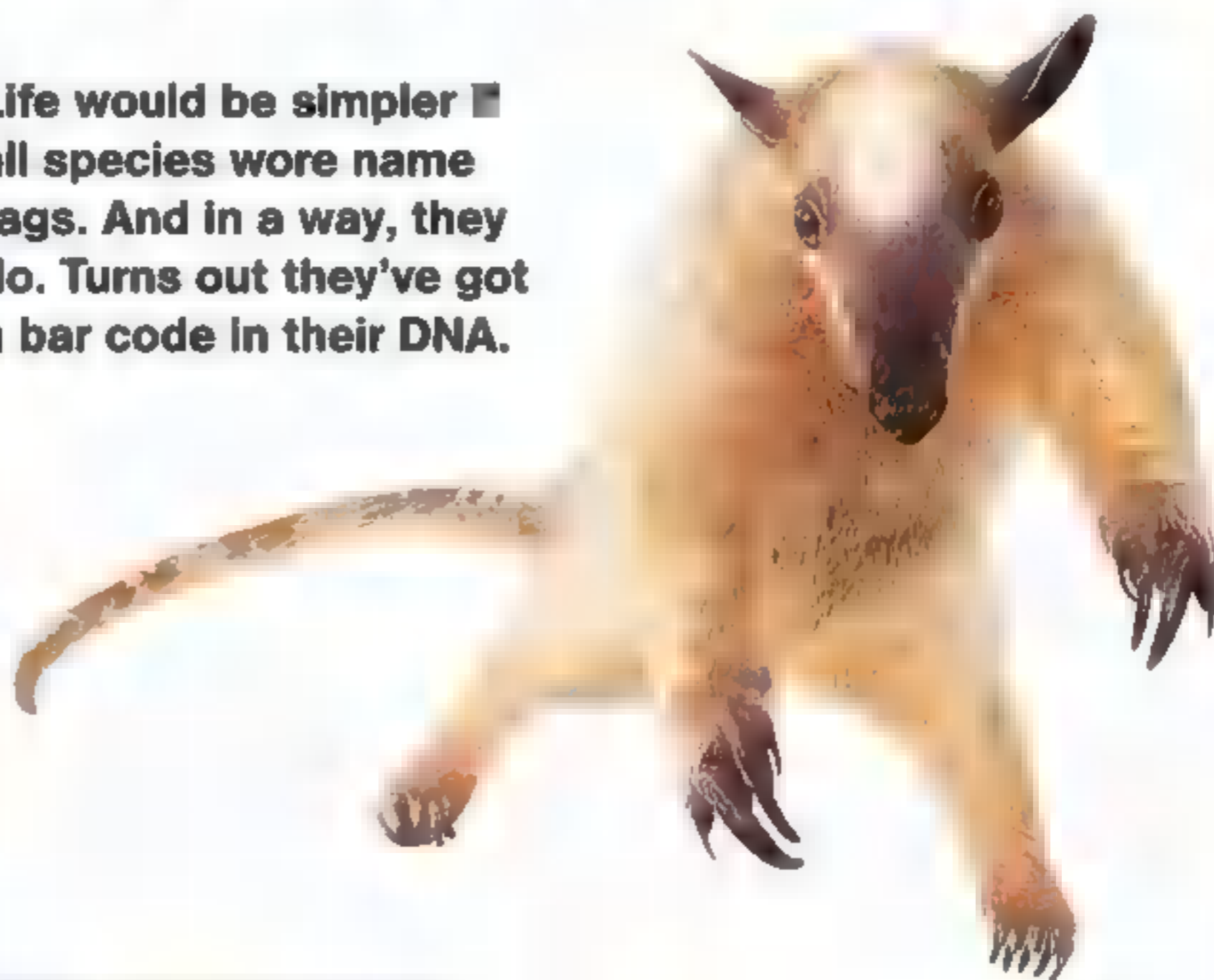


AFRICAN ELEPHANT (*LOXODONTA AFRICANA*)

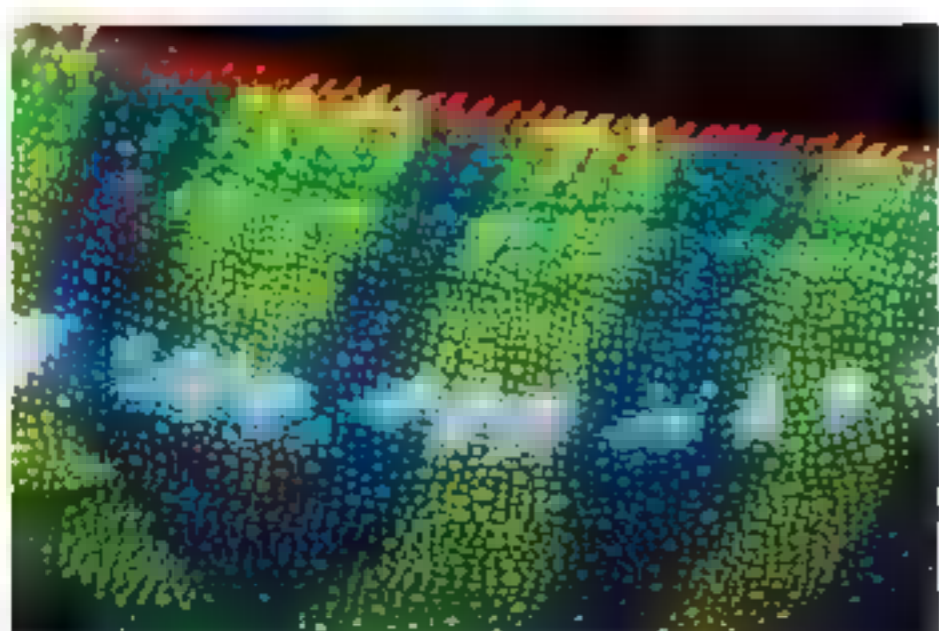


BONGO (*TRAGELAPHUS EURYGERUS*)

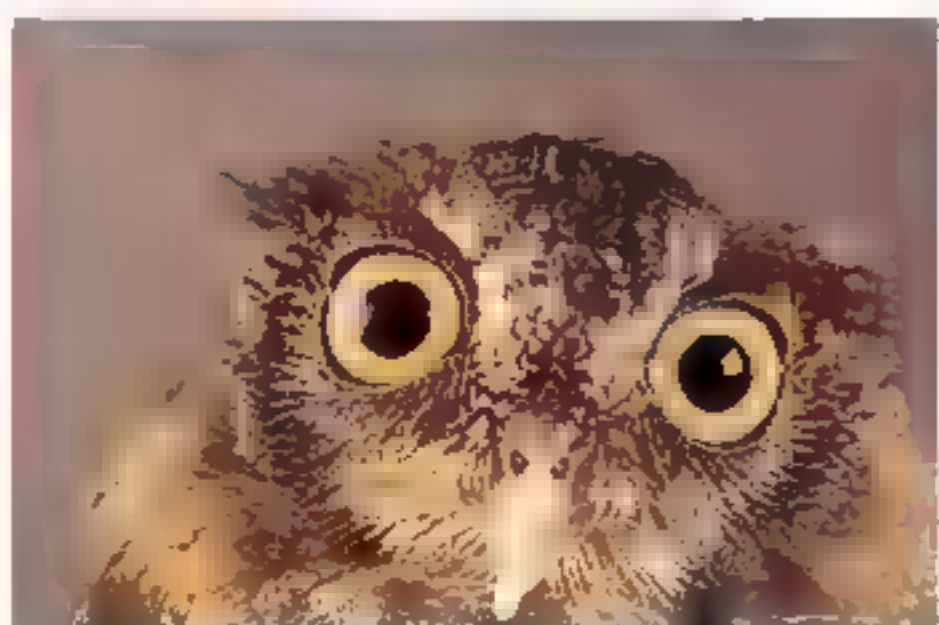
Life would be simpler if all species wore name tags. And in a way, they do. Turns out they've got a bar code in their DNA.



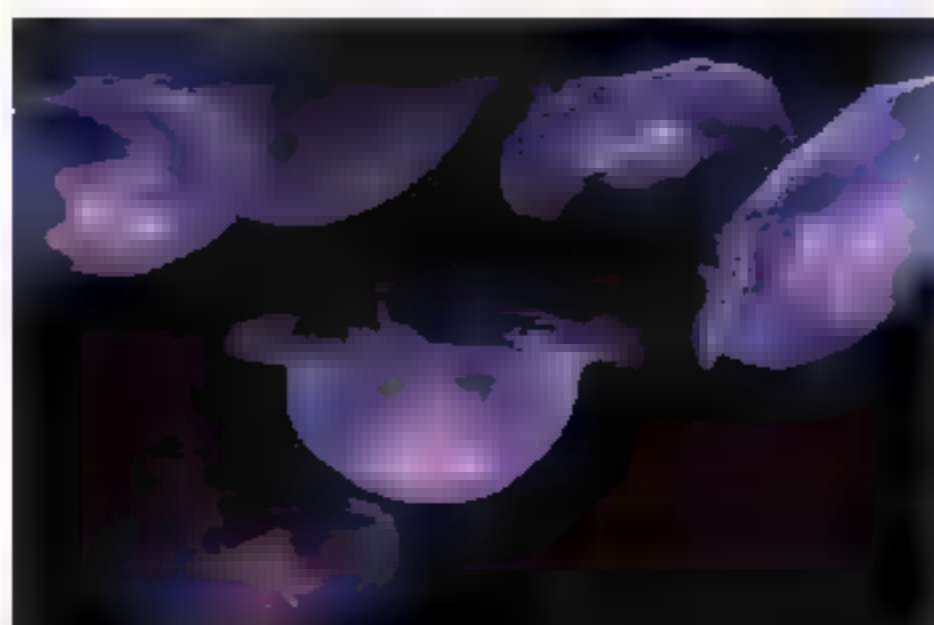
TAMANDUA (*TAMANDUA TETRADACTYLA*)



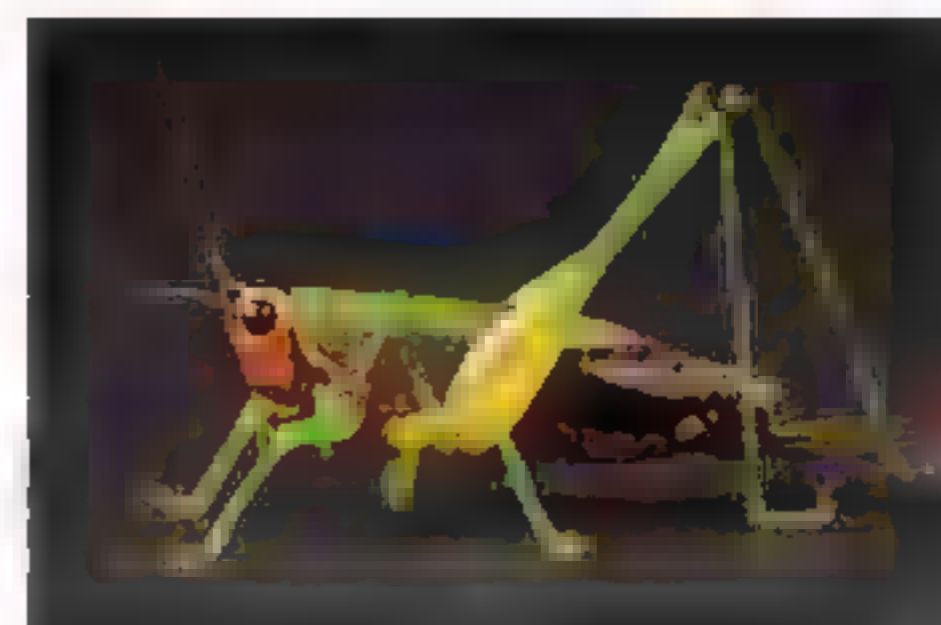
PANTHER CHAMELEON (*FURCIFER PARDALIS*)



EASTERN SCREECH-OWL (*MEGASCOPS ASIO*)



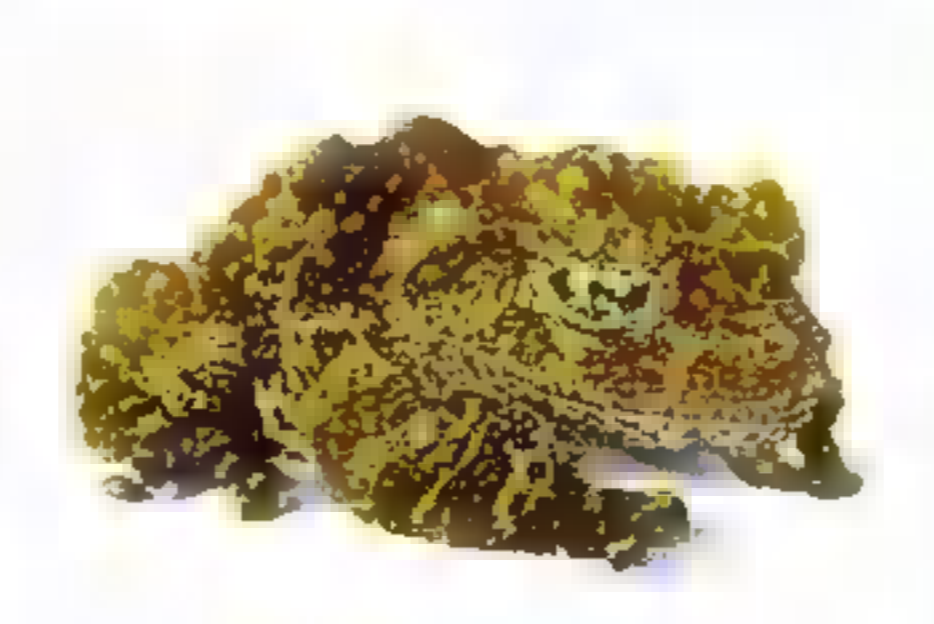
MOON JELLIES (*AURELIA AURITA*)



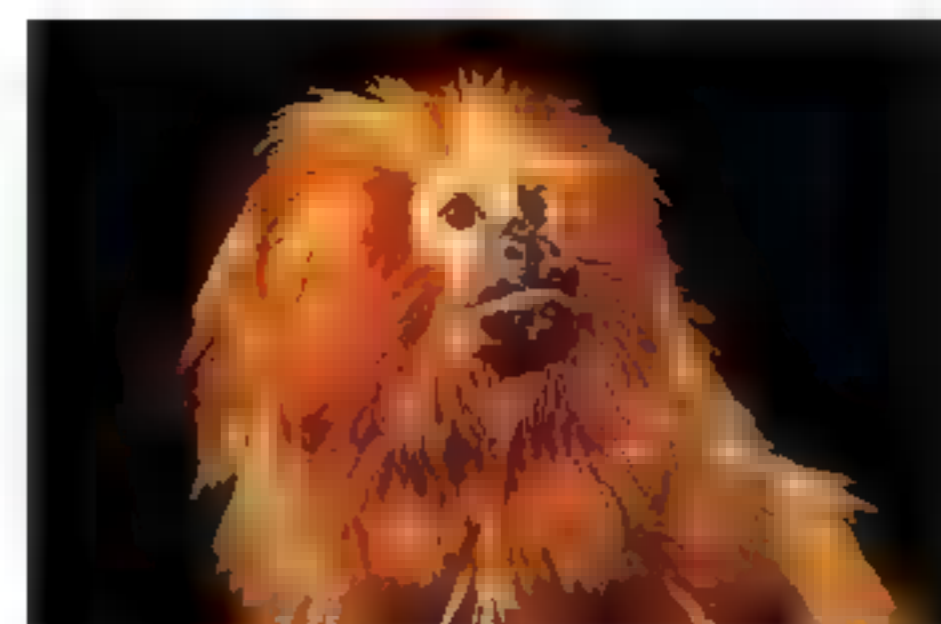
KATYDID (*ORCHELIMUM SP.*)



BLACK SWALLOWTAIL BUTTERFLY (*PAPILIO POLYXENES*)



VIETNAMESE MOSSY FROG (*THELODERMA CORTICALE*)



GOLDEN LION TAMARIN (*LEONTOPITHECUS ROSALIA*)



FLORIDA SCRUB MILLIPEDE (*FLORIDOBOLUS PENNERI*)



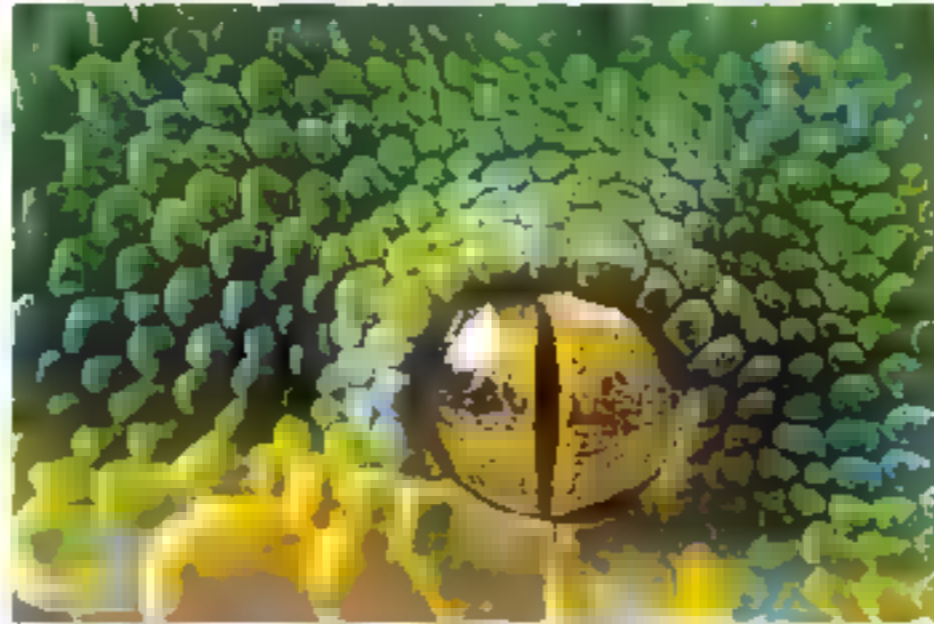
FIVE-LINED SKINK (*PLESTIODON SP.*)



PALLID BAT (*ANTROZOUS PALLIDUS*)



PALM COCKATOO (*PROBOSCIGER ATERRIMUS*)



GREEN TREE PYTHON (*MORELIA VIRIDIS*)

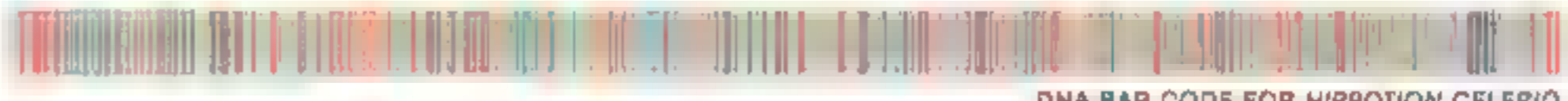


SILVER-STRIPED HAWK MOTH (*HIPPOTION CELERIO*)



BLACK LEMUR (*EULEMUR MACACO*)

Scanning Life



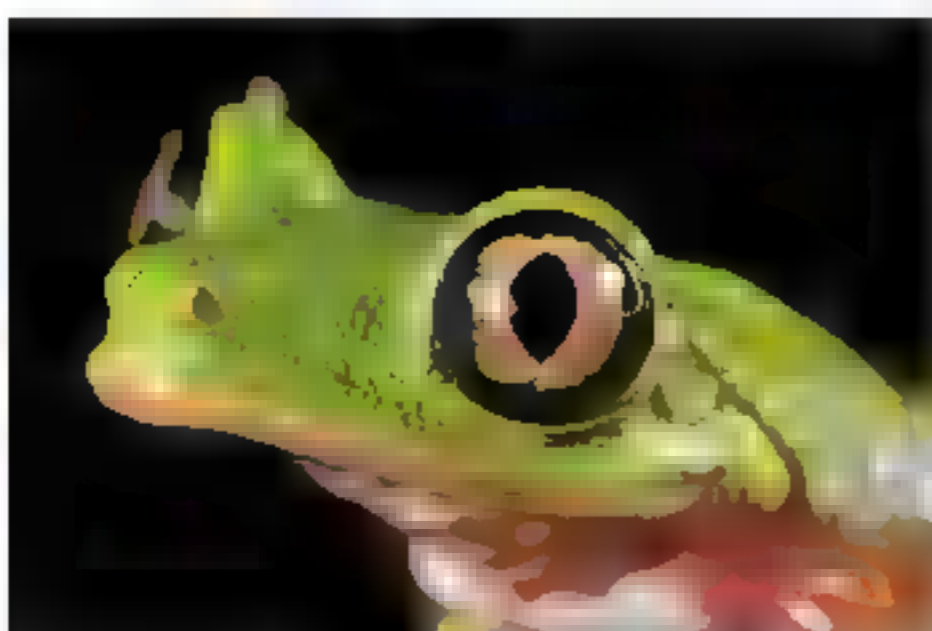
DNA BAR CODE FOR *HIPPOTION CELERIO*



TIGER (*PANTHERA TIGRIS*)

IF YOU TURN ON A LIGHT AT NIGHT in the mountains of Papua New Guinea, says Paul Hebert, you will collect some 2,000 species of moth. Moving up the mountain a bit will net you a different but equally daunting crowd. As a young postdoc in the 1970s, Hebert, now an evolutionary biologist at the University of Guelph in Ontario, spent five years trying to make sense of that fluttering confusion, before finally deciding it was beyond his or any human's capacity. For two decades after that he retreated to water fleas, of which there are only 200 species. Then in 2003 he did something new. In a paper that year he began by describing the diversity of life as a "harsh burden" for biologists, and proceeded to suggest some relief: Every species on Earth could be assigned a simple DNA bar code, Hebert wrote, so it would be easy to tell them apart.

The bar code Hebert suggested is part of a gene called CO1, which helps produce the energy-carrying molecule ATP. CO1 is so essential that every multicellular (Continued on next page)



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luxurious LCD chronograph that is sophisticated enough for a formal evening out, but rugged and tough enough to feel at home in a cockpit, camping expedition or covert mission.

The watch's extraordinary dial seamlessly blends an analog watch face with a stylish digital display. Three super-bright luminous hands keep time along the inner dial, while a trio of circular LCD windows track the hour, minutes and seconds. An eye-catching digital semi-circle animates in time with the second hand and shows the day of the week. The watch also features a rotating bezel, stopwatch and alarm functions and blue, electro-luminescence back-light. The *Compendium Hybrid* secures with a rugged stainless steel band and is water-resistant to 3 ATMs.

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Tolypeutes matacus, the southern three-banded armadillo of South America, can close its shell in a tight ball. Like all creatures, it has a bar code represented by four colors—one for each of the DNA bases (G, T, C, and A).

organism has it. But there is enough variation in its sequence—each of the 600-odd spots in the bar code region can be filled by any of four different DNA bases—that two species rarely have the exact same one. Such differences in a gene are readily scanned by machine even when the animals themselves might confound an expert; Hebert's group is now sequencing a thousand specimens a day. They've bar coded nearly 40,000 species of moth and butterfly already. The technique has commercial as well as scientific promise. Mislabeling of fish on menus is rampant, it turns out.

Bar coding has spread throughout the animal kingdom and even to plants and fungi. With a seal of approval from the United Nations, which has declared 2010 the International Year of Biodiversity, researchers in 25 countries are now aiming to bar code 500,000 species—of the 1.7 million already named on Earth—by 2015. "I'm convinced

this approach is scalable to the planet," says Hebert. "Any species humans encounter frequently will be bar coded by 2025."

Some biologists dislike that grand plan; they worry that bar coding, which is best at identifying species that have already been described, will steal scarce research dollars from the more valuable work of describing unnamed species. Hebert sees the technique as popularizing biodiversity at a time when it is vanishing fast. People are now sending him specimens from their backyard to identify, but within ten years, he thinks, the technology will follow the path of GPS: Someone will invent a handheld DNA bar coder. "I can imagine every kid getting one of these in his or her Christmas stocking," Hebert says. When those kids grow into postdocs, they'll be better equipped to plunge into the wilds of New Guinea and sort out the moths. —Robert Kunzig





Mount Helens, flanked by Mount Adams (far left) and Mount Hood, settling fitfully into the volcanic landscape. Three decades ago the mountain's eruption killed 57 people and destroyed more than 200 square miles of forest.



Mountain Transformed

Thirty years after the blast, Mount St. Helens is reborn again.

RODGER WERTH / DAILY

Torn from the hills, thousands of dead trees still float on Spirit Lake. Toxic in the immediate aftermath of the blast, the lake is now richer than ever—filled with tadpoles, aquatic plants, and 20-inch rainbow trout. Left: the morning of May 18, 1980.





Beer cans once lay at the bottom of Spirit Lake.

Mark Smith remembers them perfectly: 20-year-old Olympia flattops, their shiny gold lettering somehow preserved by the clear, cold water. He remembers ten-inch rainbow trout: planters for the tourists. He remembers a sunken rowboat from the YMCA camp, its bow resting on a submerged stump. A teenager when he began scuba diving in the shadow

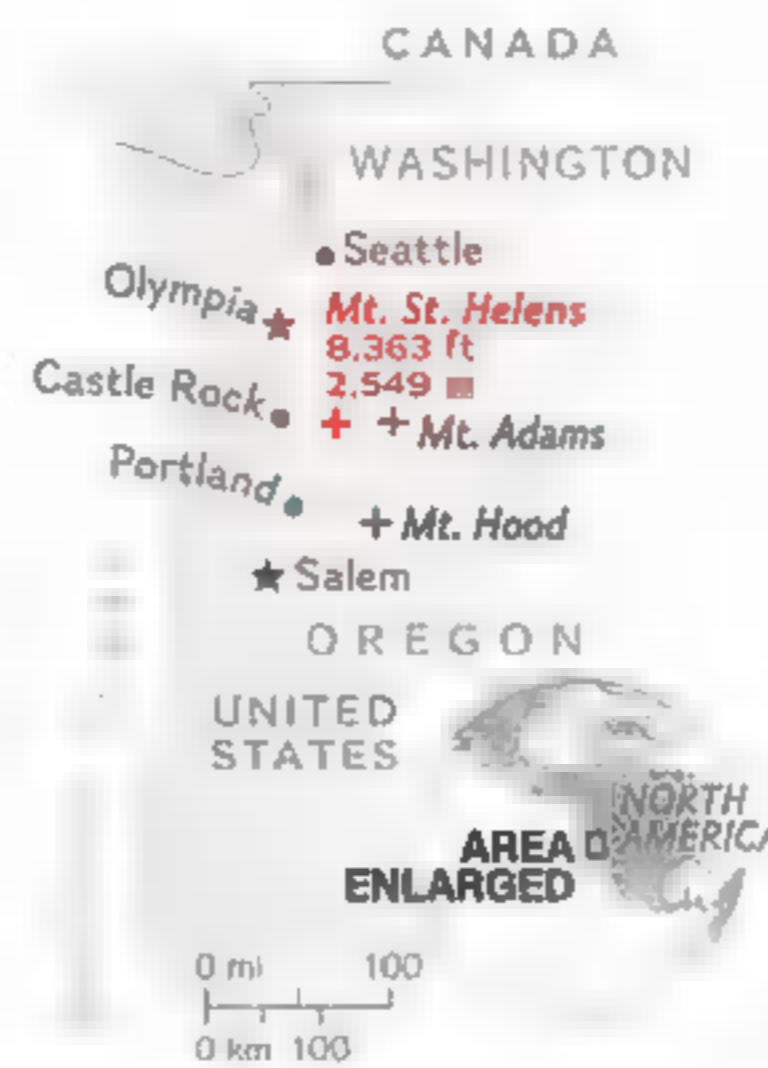
of Mount St. Helens, he remembers the lake as it was before the May 1980 eruption, before the top 1,300 feet of the volcano—more than three billion cubic yards of mud, ash, and melting snow—avalanched into it. Before the lake became twice as big but half as deep. Before virtually all evidence of life, animal and human—the cabins and roads and camps and cans—were obliterated. Before the lake became a stinky soup, devoid of oxygen and covered with a floating mat of tree trunks ripped from the landscape. What Smith remembers best is what he called the “petrified” forest: a ghostly stand of sunken, branchless firs, buried upright dozens of yards below the surface. The underwater forest was a mystery to him until the mountain exploded. Then it made perfect sense. The trees were evidence of a past eruption—a sign Spirit Lake has always been in the line of fire.

Three decades later, Spirit Lake holds a new mystery: How did fish, now twice the length of those pre-eruption rainbows, reappear? Everyone has a theory. Smith, who runs Eco Park Resort at the edge of the volcanic monument, thinks the trout slid down from smaller, higher St. Helens Lake during a flood year. But that lake has only mackinaw—and the Spirit Lake fish are rainbows. Biologist Bob Lucas of the Washington Department of Fish and Wildlife believes someone illegally planted them. In

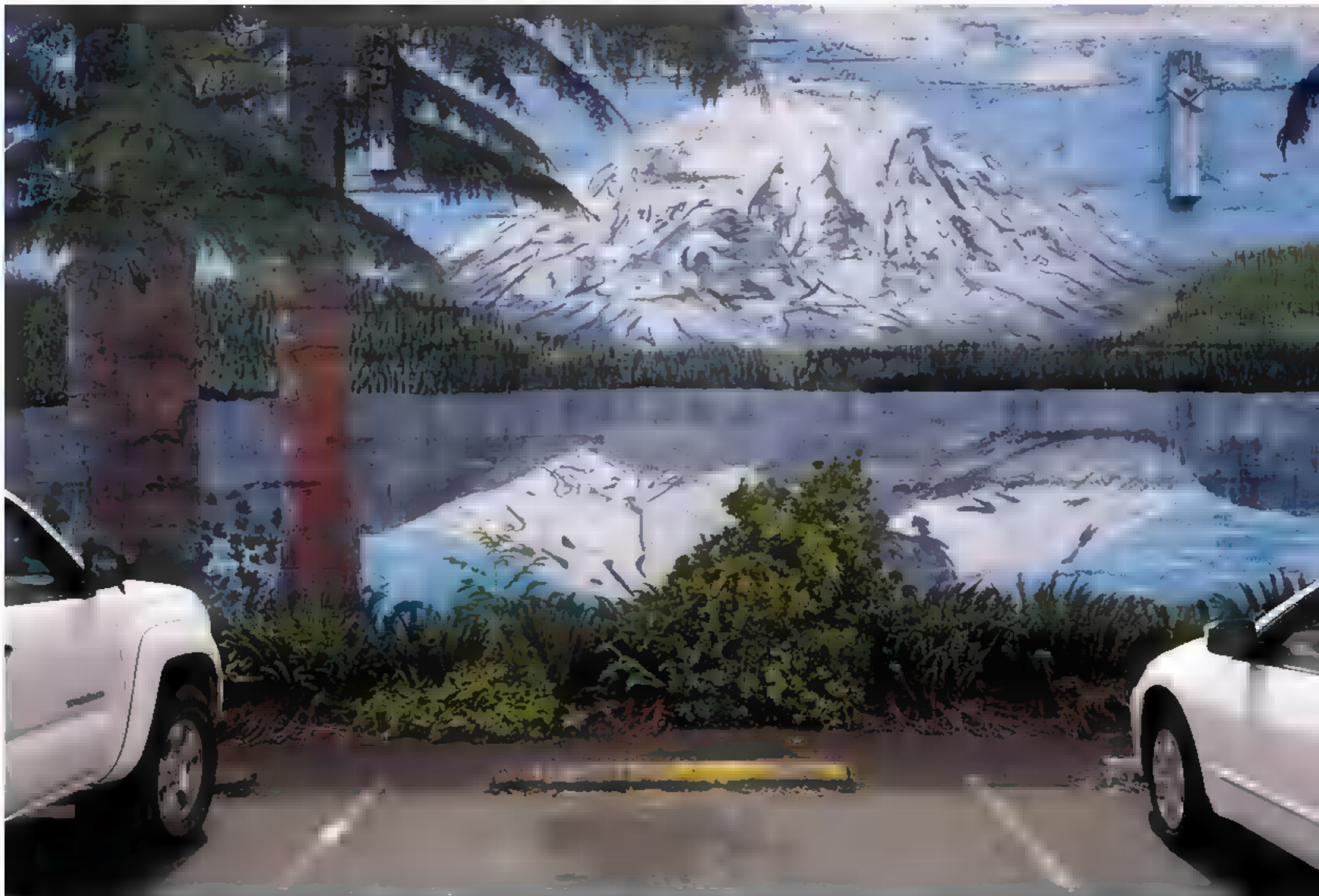
the late 1990s, an anonymous call to his home seemed to confirm it: “I’m the one who stocked the fish.” Preliminary genetic testing by Forest Service ecologist Charlie Crisafulli also suggests the trout did not descend from the pre-eruption population, but he’s given up on figuring out their origin. “There are as many stories as there

are fish tales,” he says, “and all of them start, ‘I know somebody who put those fish in there.’” To him the important question is not how they arrived but how they grew so big. On the 30th anniversary of the May 18 eruption, one of the only things certain about the trout in Spirit Lake is that they’ve given everyone—environmentalists, scientists, fishermen, congressmen, rangers, and business owners—something else to argue about.

Mark Smith grew up at the lake, where his family ran the lodge one down from the one owned by Harry Truman, the famously cantankerous 83-year-old who shared a name with a President and was among the eruption’s 57 victims. As a boy, Smith fished there. Today he’d have to break the law to do so. He’s not saying he does, but if ever I want to join him, he is, ahem, very familiar with where a poacher could sneak in. “We were lost!” he yells, practicing his alibi. “We just saw this and started fishing!” The 2,700-acre lake now sits at the center of a restricted research area taking up roughly a quarter of the 110,000-acre Mount St. Helens National Volcanic Monument, which Congress set aside in 1982 “to protect the geologic, ecologic, and cultural resources...in as natural a



McKenzie Funk wrote “Arctic Landgrab,” and Diane Cook and Len Jenshel photographed buildings with green roofs, both in the May 2009 issue.



Why show St. Helens with its summit intact? Ramona Kmetz Lauzon, who painted the mural in Castle Rock, Washington, in 1996, explains, "People said they'd rather see the old mountain."

state as possible, allowing primarily natural geologic forces and ecological succession to continue unimpeded." Mostly closed to the public, this part of the blast zone has become one of our planet's grandest experiments.

The volcano came back to life from 2004 to 2008, shooting off plumes of steam and ash up to 30,000 feet into the sky, growing a new lava dome in its crater, and captivating sightseers and geologists. But many of the area's greatest insights have come in the field of ecology.

As a natural lab to study the rebirth of ecosystems, the blast zone has no equal. "It's the most thoroughly studied large-forest disturbance

in the world," says Crisafulli, examined from nearly every angle, at nearly every scale, from molecules to ecosystems, bacteria to mammals, steaming geothermal vents to waterlogged meadows. Almost daily, callers inquire about the lessons of St. Helens. One woman is interested in salamanders, another in toads. Officials in Alaska and Chile want to know what to expect after eruptions of their own.

A key lesson is the importance of "biological legacies"—fallen trees, buried roots, seeds, gophers, amphibians—that survived the blast, thanks to snow cover, topography, or luck. Ecologists had assumed rebirth would happen from the outside in, as species from border areas encroached on the blast zone. But recovery has also come from within. Starting with a single plant Crisafulli discovered in 1981 on the barren, 3,750-acre expanse known as the Pumice Plain, purple prairie lupines



became the first color in a world of sterile gray. In life they were nutrient factories, food for insects, habitat for mice and voles; in death they, and the organisms they attracted, enriched the ash, allowing other species to colonize. Gradually the blast zone began to bloom.

Take a broad view, and you see that humans are also part of the St. Helens experiment. What captivated the country 30 years ago was not just the size of the blast but that it happened to us, to people we understood and a landscape we loved. Now, as nature springs back and memories fade—and budgets and visitor numbers fade as well—humans are becoming restless. Some say the monument should be wrenched from the Forest Service and made a national park. Others hear tales of two-foot trout and wonder why Spirit Lake is still off-limits. Last spring a bill to open it to limited fishing passed 95 to 1 in the Washington State House before stalling in

Early colonists bloom on a hill near the volcanic monument's Coldwater Lake: foxglove, lupine, pearly everlasting, red alder. The tree stump is a reminder of pre-1980 logging operations.

the senate. Some locals grumble that 30 years of research is enough—that it is time to open the restricted zone. None of this should surprise us. Even on a human scale, St. Helens is an ecosystem trying to find equilibrium.

What I remember from my swim in Spirit Lake is not a sunken forest but an underwater jungle. Last August I drove behind Crisafulli on a sinuous two-lane road along Windy Ridge, through a damaged gate secured by a makeshift chain—“You’d think there’d be enough money to buy a new damn gate,” Crisafulli said—and

down a scary, slopeside jeep trail into the restricted area. At the edge of the Pumice Plain we began the two-and-a-half-mile walk that the lean 52-year-old has taken thousands of times. His ponytail swung with each step. He talked ecology almost nonstop, his New York accent still discernible after 30 years in the blast zone. Behind us was the volcano, snowless and gray, its northern wall collapsed, its crater exposed. In front was the lake, its surface calm and two-fifths covered by the “log raft,” a shifting mass of thousands of floating logs. Along the trail were fir saplings, lupines, and Indian paintbrush, 15-foot-tall thickets of willow and alder, and, near a stream, hordes of toads and tree frogs. At the lake’s edge, we got into warm fleece overalls that Crisafulli called bunny suits, into dry suits and masks and snorkels, and into a Zodiac raft, which motored into Duck Bay. And then into the frigid water.

The first surprise was the colors: brilliant yellows and greens, electric in the sunlight, a world apart from the drab Pumice Plain. They belonged to aquatic plants, thick, vine-like macrophytes stretching ten feet from lake bed to surface. Mossy clumps were suspended above the silt. Everywhere I turned were fish, hook-jawed and fat, all of them 20 or more inches. I swam after them. They didn’t spook. The sunken jungle, I noticed, was only in the shallows. In deeper water it was gone—and so were the fish.

Before the eruption Spirit Lake was, like many subalpine lakes, unproductive and nutrient-poor, with clear water and few shallow spots. When the volcano top slid into it at 150 miles an hour, it became choked with what Crisafulli terms “pyrolyzed forest constituents”—organic material burned in the blast. The water was warmed to body temperature, filled with dissolved carbon, manganese, iron, and lead. Visibility went from 30 feet to six inches. Bacteria flourished. The first scientists to take water samples came down with unexplained ailments. There was a rapid succession of microbes: aerobes, which quickly used up all the oxygen; anaerobes, which require none; then nitrogen-consuming

bacteria; and then forms that fed on methane and heavy metals. For 18 months Spirit Lake was ruled by chemistry, home to “hundreds of millions of bacteria per milliliter,” Crisafulli says. Finally, the microbes had consumed so much that they began to die off, and streams and snowmelt came in, and the water cleared.

Once light penetrated Spirit Lake, algae and other phytoplankton colonized, followed by zooplankton, which fed on the phytoplankton, followed by aquatic insects and amphibians. By the early 1990s, macrophytes grew in shallow shoals—ideal trout habitat that didn’t exist before the eruption. Gorging on tiny midges and freshwater snails, the rainbows were reaching a record four or five pounds in two or three years. The post-eruption lake followed a pattern Crisafulli would see many times in the blast zone. New organisms colonize the virgin environment with dramatic success, only to burn themselves

Some hear tales of two-foot trout and ask why Spirit Lake is off-limits. Others grumble that it is time to open the restricted zone.

out or be checked by predators, parasites, or competitors. This was the second revelation of St. Helens: When there’s a blank slate, ecological succession is a cycle of boom and bust.

Spirit Lake’s richness is spilling over. When a tadpole dies as a frog on the Pumice Plain, when an insect hatched in the lake is deposited in the ash, their nutrients are transferred to land. Slowly this process undoes what the eruption wrought. “Before the eruption, the terrestrial environment was superproductive,” Crisafulli says, with “lots of nutrients and carbon tied up in the old-growth forest. In comparison, the lake was impoverished. After the eruption they



Along the braided North Fork Toutle River, ash-laden sediment clogs the valley bottom, choking stands of fir and alder. In the early 1980s, the river carried 500 times more sediment than before the eruption.





Spirit Lake, a cauldron of debris and bacteria, naturally cleared enough by the early 1990s to sustain fish.

Old shape

Drifting raft of uprooted trees

Blast deposits and ash are about 1.5 feet deep at this site.

Snowpack

Original soil

POST-ERUPTION
A time-lapse portrait covering 30 years highlights survivors and early colonists that have played key roles in renewing Mount St. Helens.

First months ▶
Pocket gophers survive in some burrows. Tunneling as they eat roots and bulbs, they push fertile soil to the surface: beds for wind-borne seeds.

Plants like glacier lilies that yearly rise through snow also rise through the ash. Huckleberry shrubs with roots protected by stumps and logs resprout.

Flexible young fir trees that had bent like hoops under the snowpack slowly straighten and break through the ash as the snow melts.

Dormant western toads and other amphibians emerge. Surviving mammals are mostly burrowers, like deer mice and pocket gophers.

SURVIVORS

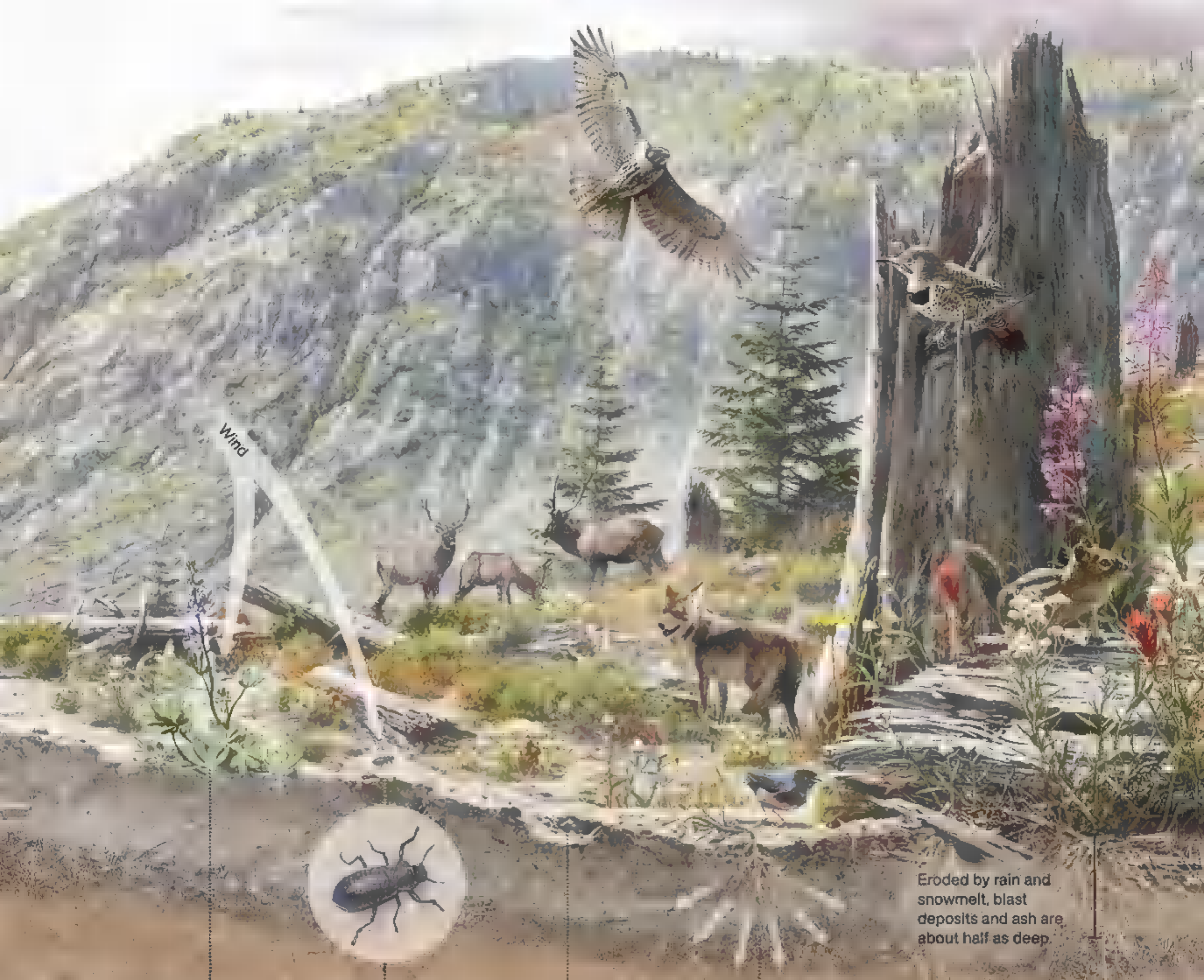
Rebirth of the Blast Zone

How does an ecosystem rebound from catastrophe? The 230-square-mile blast zone around Mount St. Helens has been a natural lab for that study. Scientists expected that renewal of the once dense evergreen forests would begin slowly, with drifting seeds and animals migrating from nearby areas. But what set the pattern of recovery, and accelerated its pace, were species that survived the blast because of protection by snow cover, topography—or luck. Says ecologist Charlie Crisafulli, “Had everything been wiped clean, it would look far different.”

Damage categories

- Forest obliterated by blast; blast deposits
- Trees blown down; blast deposits
- Trees scorched; some blast deposits
- Trees unaffected apart from ashfall
- Landslide and pyroclastic flow deposits
- Mudflow deposits

SCALE VARIES IN THIS SOUTH-LOOKING PERSPECTIVE. DISTANCE BETWEEN JOHNSTON RIDGE OBSERVATORY AND MOUNT ST. HELENS'S SUMMIT ■ SIX MILES (TEN KILOMETERS).
ART: FERNANDO G. BAPTISTA, NGM STAFF; TONY SCHICK, MAP: MARTIN GAMACHE, NGM STAFF. SOURCES: PETER FRENZEN, U.S. FOREST SERVICE (ART); U.S. FOREST SERVICE AND USGS (MAP)



Eroded by rain and snowmelt, blast deposits and ash are about half as deep.

First years ▶

Carried by wind or water, seeds of pearly everlasting and fireweed take root. Purple lupines add nitrogen to the sterile volcanic substrate.



Beetles, other insects, and ballooning spiders arrive soon after the blast but, like other colonizers, require years to establish a breeding population.

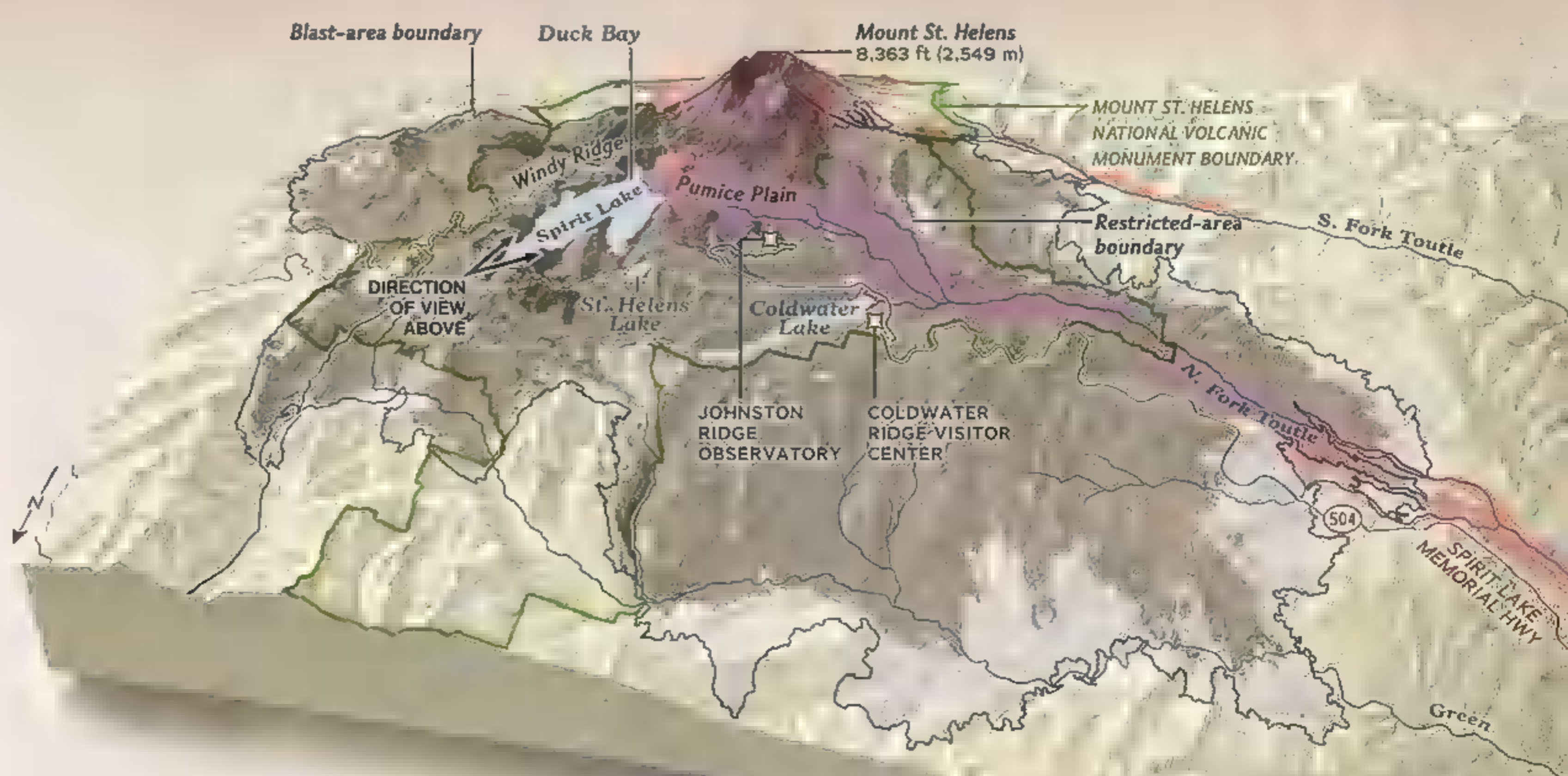
Elk hooves break up ashy crust, aiding its erosion and helping mix ash with soil. Hoofprints gather detritus in which plants can grow. Elk dung spreads seeds.

Prey attracts predators—coyotes and hawks. In the renewed cycle of life and death, animals and plants add organic matter to rebuild soil.

TODAY

Survivor evergreens are producing seeds: Within 50 years a young forest will stand. In 200 years the forest will look as it did before the blast.

COLONIZERS



flip-flopped.” Now the landscape is going back from gray to green, and the lake is becoming more like its former self.

At 20 inches and two and a half pounds, the rainbows I saw were as large as any I’ve caught in a lifetime of fishing the Pacific Northwest—but the fish, too, were becoming more like their former selves. Nine years after Crisafulli began

If the two decades following the eruption were the monument’s boom, today has the appearance of a bust.

tagging them, either because Spirit Lake is becoming less productive or because too many trout now vie for the same amount of food, or both, their average weight has been cut in half.

Some fly fishers see the ongoing changes in Spirit Lake as a problem—of overpopulation—and offer themselves as the solution. “There’s a world-class fishery going untapped, and it’s the right of the citizens to fish it,” Denny Way tells me. The president of the Clark-Skamania Flyfishers club, he’s proposed opening up Spirit Lake before the trout shrink: ten catch-and-release fly fishers, along with a trained host, one day a week. The scientists, meanwhile, note that a dozen neighboring lakes are open to fishing but are undervisited and that at Spirit the danger is not the numbers but the precedent: ten fishermen or a hundred, the door would be open. Nominally about fish, the argument goes deeper: What should the monument be for?

The question is everywhere. If the two decades following the eruption were the monument’s boom—five visitor centers, hundreds of miles of roads, millions of sightseers—today has the

appearance of a bust. The largest center, Coldwater Ridge, where exhibits focused on biological recovery, closed in 2007 as budgets shrank. The west side has only two full-time interpretive rangers; the south and east, only one. The monument’s life-support system is volunteers from the nonprofit Mount St. Helens Institute, seasonal workers, and interns. Seventy percent of its roughly \$1.8-million recreation budget comes from user fees. The rest is tied to that of Gifford Pinchot National Forest, and funds increasingly go to firefighting. While statistics are scarce—another victim of the budget crunch—monument staff and business owners like Mark Smith agree that visitation has fallen far from the heyday of the 1980s and ’90s. A quarter of those who now come are foreigners, who camp out or stay in nearby lodges. Americans tend to make day-trips, driving up Spirit Lake Memorial Highway and past the shuttered Coldwater center to an overlook, then heading back to Interstate 5.

Some hope for a Mount St. Helens National Park, with congressional funding, lodging, and more money for more science. Funds are starting to flow, with more than \$6 million in federal stimulus last year, plus a \$163,000 grant to the Mount St. Helens Institute for an exhibit at the end of the Spirit Lake Memorial Highway. The 30th anniversary means renewed interest. “In my talks at St. Helens I tried to get people to realize that the volcano is not static,” says the National Parks Conservation Association’s Sean Smith, a former St. Helens ranger now pushing for park status. “I’d hold up an Etch A Sketch and say the monument’s like this drawing. The forces of nature control one knob. The public has the other.”

“In the larger story of St. Helens, park versus monument is a blip in history,” says monument staff scientist Peter Frenzen, who started alongside Crisafulli in the weeks after the eruption. “Access to Spirit Lake is a blip in history.” Those who’ve walked the blast zone for three decades see the beginning of a more profound process. Breakthroughs are fewer—one plant pushing through the ash is no longer a miracle—but



A ghostly stand of trees eight miles from St. Helens shows how pre-blast remnants can shape the ecosystem's recovery. Nurtured and shaded by the old forest, a new forest rapidly grows.

the pace of change is accelerating, the scale broadening. Instead of eureka moments, there is something approximating wisdom.

“Right now, the Pumice Plain is like a runaway horse,” Crisafulli says. “Individual plots can’t address the evolution.” He plans to survey by satellite and airplane—tools that can see the big picture as the pixels fill in. “We’re moving to broad-scale biogeography,” he says. “It’s the next frontier.”

Another sunny day last summer, I again hiked across the Pumice Plain, this time to join three young scientists Crisafulli had recruited to survey Spirit Lake. The goal was to

create the first ecosystem-scale map of the aquatic environment—patches of plant life, submerged mounds that had slid from the top of the volcano, fish in the water column. An echo sounder clamped to our boat’s starboard side, our motor idling, our wary eyes on the log raft—it could cut us off on the wrong side of the lake if the wind blew—we crept forward. St. Helens, what was left of it, filled the horizon. On a digital display, the scientists pointed out strange squiggles—either trout or sunken logs, suspended vertically. We wouldn’t know which until the data went to the lab. So they took me to a shallower spot, just south of what used to be Harmony Falls, where they knew what they were looking at. When I peered into the clear water of Spirit Lake, I also knew. Three decades after the eruption, with the mountain calm and the lake alive, I saw what Mark Smith had seen: a petrified forest. □



On the regreening Pumice Plain, the elk population has soared, causing game managers to invite the first post-eruption hunters—eight a year—into the restricted research area.





Buried in ash and washed out by mud slides,
then controversially rebuilt in the 1980s and '90s
at a cost of \$160 million, State Route 504 leads to
the Johnston Ridge Observatory, overlooking the
Pumice Plain and Mount St. Helens's gaping crater.



TROUBLED SPIRITS

IN MEXICO, THE HARSH REALITIES OF DAILY LIFE HAVE ELEVATED UNHOLY SAINTS, WHO NOW STAND BESIDE TRADITIONAL ICONS.





... strength—and hope
of desperate cause.





Death is not the end of bravado for Mexican drug traffickers laid to rest in lavish mausoleums at a cemetery in Culiacán, heart of the Sinaloa cartel. The woman in the foreground is the wife of a construction worker.

By Alma Guillermoprieto

Photographs by Shaul Schwarz

The inmate known as El Niño, or Little Boy, entered the Center for Enforcement of the Legal Consequences of Crime nine and a half years ago. Tall and gangly, with a goofy, child-like smile, he appears never to have grown up, though the memory of his deeds would make another man's hair go white. Abandoned by his father when he was seven years old and raised by his maternal grandparents, he was 20 when he committed the murder that landed him in this prison in the north of Mexico. His buddy Antonio, neatly dressed, alert, quick moving, and round eyed, was shoved into the same holding cell, charged with kidnapping. "We've been friends since then," one says, as the other agrees.

When he will leave prison is anyone's guess, but El Niño has reason to feel hopeful: He relies on a protector who, he believes, prevented jail wardens from discovering a couple of strictly forbidden objects in his possession that could have increased his punishment by decades. "The guards didn't see a thing, even though they were right there," he says. This supernatural being watches over him when his enemies circle around—and she is there, as Antonio says in support of his buddy's faith, after all the friends you thought you had have forgotten your very name, and you're left, as the Mexican saying goes, without even a dog to bark at you. This miracle worker,



In an area of Tijuana where drug use is common, inked skin depicts callings of the flesh and spirit alike. On the forearm of the man in the black shirt is a figure holding a scythe: La Santa Muerte—Holy Death—icon of a growing cult. Devotees say that as long as vows to her are kept, La Santa Muerte accepts you without judgment, no matter what your crimes.



this guardian of the most defenseless and worst of sinners, is La Santa Muerte, Holy Death.

SHE IS ONLY ONE among several otherworldly figures Mexicans have been turning to as their country has been overwhelmed by every possible difficulty—drought, an outbreak of swine flu followed closely by the collapse of tourism, the depletion of the reserves of oil that are the main export, an economic meltdown, and above all, the wretched gift of the drug trade and its highly publicized and gruesome violence. Although the total number of homicides in Mexico has actually decreased steadily over the past two decades,

the crimes committed by the drug traders are insistently hideous and have so disrupted the rule of law that ordinary Mexicans regularly wonder aloud whether *las mafias* have already won their war against the Mexican state.

“The emotional pressures, the tensions of living in a time of crisis lead people to look for symbolic figures that can help them face danger,” says José Luis González, a professor at Mexico’s National School of Anthropology and History who specializes in popular religions. Among the helper figures are Afro-Cuban deities that have recently found their way to new shores and outlaws that have been transformed

into miracle workers, like a mythical bandit from northern Mexico called Jesús Malverde. There are even saints from the New Testament repurposed for achieving not salvation but success. In this expanding spiritual universe, the worship of a skeleton dressed in long robes and carrying a scythe—La Santa Muerte—is possibly the fastest growing and, at first glance at least, the most extravagant of the new cults. “If you look at it from the point of view of a country that over the last ten years has become dangerously familiar with death,” González says, “you can see that this skeleton is a very concrete and clear symbolic reference to the current situation.”

Unknown to most Mexicans until recently, this death figure resembles medieval representations of the grim reaper but is fundamentally different from the playful skeletons displayed on Day of the Dead—the day when Mexicans’ departed loved ones return to share with the living a few hours of feasting and remembrance. Her altars can now be found all over Mexico, on street corners and in the homes of the poor. Women and men alike are her followers. In the heart of Mexico City, in a neighborhood that has always been raucous and defiant, Enriqueta Romero leads a prayer session in honor of the skeleton every first of the month. Simultaneously flinty, foulmouthed, and motherly, Romero was among the first and the most effective propagandizers of a cult that some believe got its start in towns along the Gulf of Mexico but now covers a wide territory up and down the country. In California and Central America as well, young people light candles in La Santa Muerte’s honor and tattoo her image on their skin in sizes small to extra large. A few years ago the Interior Ministry revoked its registration of La Santa Muerte as a legitimate religion, to no effect. Newsstands sell instructional videos showing how to pray to the saint, and even chic intellectuals are beginning to say that the cult is *muy auténtico*.

IT’S NOT ONLY THE CRISIS but also the types of problems people face these days that have fueled the expansion of the cults. Let’s say, for example, that you live in one of the cities along the border taken

over by the drug trade and that the crackle of machine-gun fire bursts out every night, filling you with terror of stray bullets. Is it not understandable to pray for protection to someone like the outlaw narco-saint Jesús Malverde, whom drug traffickers revere? Mexicans who retain a strong connection to the Roman Catholic faith might turn instead to St. Jude Thaddeus. At a time when no-win situations abound, he is experiencing a rise in popularity comparable only to that of La Santa Muerte, perhaps because he is known in the Catholic Church as the patron saint of desperate causes.

Fifteen years ago a sun-weathered man named Daniel Bucio first prayed to St. Jude, and six years ago, he says, the saint answered his prayers and granted his mother release from a long and painful illness. Now Bucio comes every month to a listing colonial church called San Hipólito just behind the main tourist corridor in downtown Mexico City to give thanks to a miraculous statue of St. Jude that was donated to the church some 30 years ago. (Historians of the drug trade might be struck by a coincidence: It was about 30 years ago that traffickers from Medellín, Colombia, who are famously devoted to St. Jude, first established trade relations with their Mexican counterparts.) St. Jude’s official feast day is October 28, and thousands of his followers feel inspired to come and pray to him on that day every month. Sixteen Masses are celebrated in the parish from dawn to evening, and worshippers crawl to the statue of the saint on their knees, praying for help, protection, and survival. The crowds are so large that police have to cordon off several traffic lanes outside the church.

Daniel Bucio loves these *romerías*, or religious fiestas, what with the jostling crowds and the street food and the endless parade of statues of St. Jude—some as large as a man can carry, some small but fantastically decorated, like his own, which in obedience to the ancient religious traditions of his hometown is dressed in a glittering ankle-length robe and the feathered headdress of the Aztec emperors. In recent years, though, Bucio’s pleasure in the monthly pilgrimage has been spoiled by growing throngs of unsmiling young men and women with tattoos and chains who arrive in groups and push their way through the crowd, often exchanging what look like small, wrapped

Alma Guillermoprieto is a frequent contributor who lives in Mexico City. Shaul Schwarz is based in New York City. This is his first story for the magazine.

DRUGS AND SAINTS

Drug cartels have destabilized many states in Mexico, where they are influencing popular culture and even religious devotion. Cartels have long fought bloody battles over narcotic supplies and smuggling routes but now may be linking up to fight increased federal efforts to curtail trafficking.



In a Los Angeles storefront "Professor Sysiphus," the Mexican-born overseer of a shrine to La Santa Muerte, reads prayer requests. A growing number of worshippers in the U.S. seek cures or help for loved ones crossing the border.



Love, money, protection...
to greet Santa Muerte with a kiss.
On the first of each month worshippers
crowd a shrine in Tepito, a Mexico City
barrio, despite the Roman Catholic
clergy's denouncement of the icon.











Say you live in a border city taken over by the drug trade, and gunfire bursts out every night. Is it not understandable to pray to the narco-saint Jesús Malverde?

candies in swift transactions. Bucio thinks he knows what they're up to.

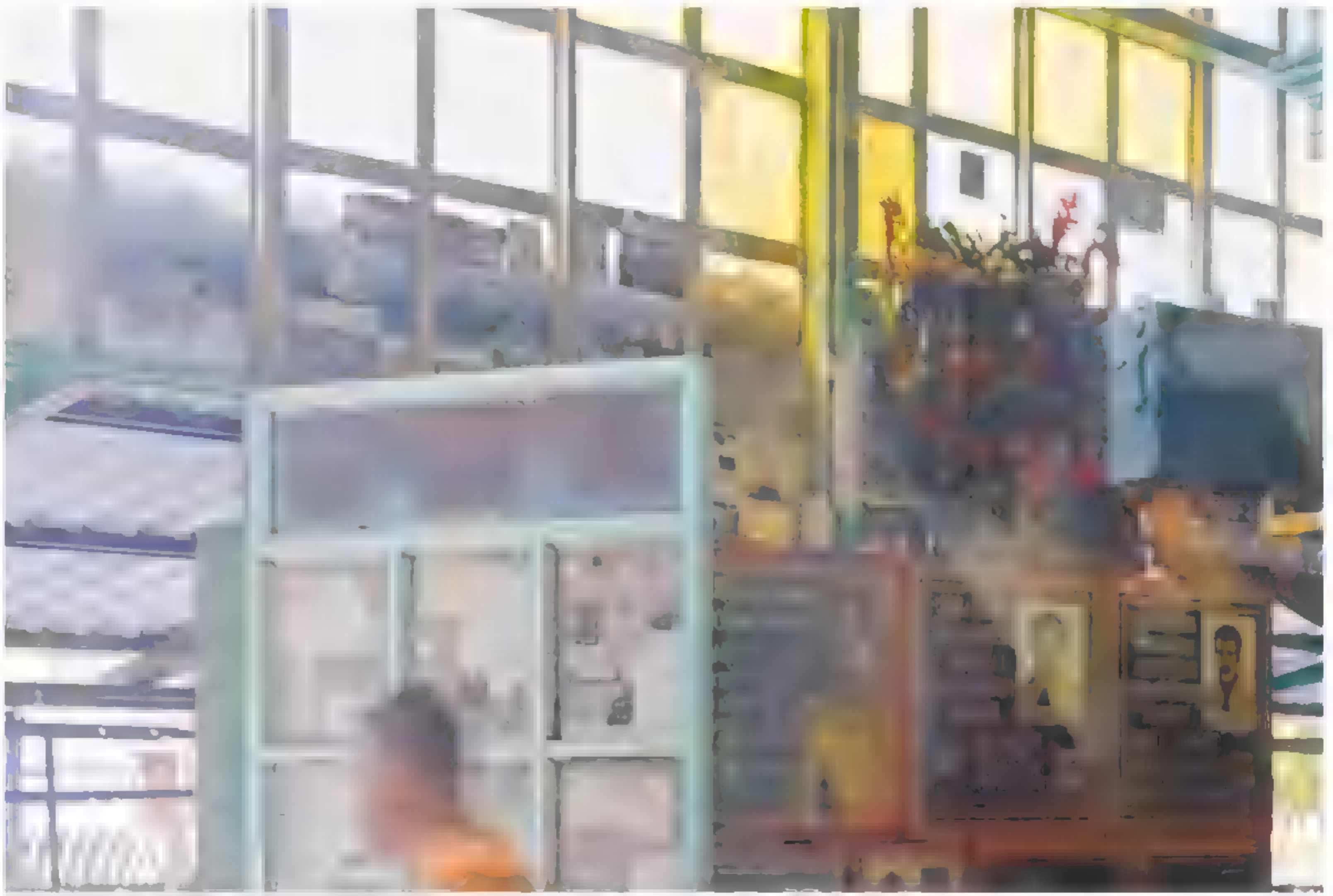
"Unfortunately a lot of these kids have taken to coming here," he says. "They sully the name of Our Lord and St. Jude's too—who have nothing to do with this *narcotráfico* thing. If everyone who came here came with sincere devotion, you wouldn't see this type of crowd."

Father Jesús García, a small, cheerful member of the Claretian Order who officiates at many of these Masses in honor of St. Jude, is aware that certain people who look as if they hope to earn a great deal of money fast come to this church to pray to the saint. But he is at pains to point out that the new devotion to St. Jude cuts across all social classes and occupations. "The other day a

politician came here asking me to help him pray for victory in the elections. Just imagine!" he exclaims, amused, shrugging off the suggestion that St. Jude might be a narco-saint. "They say that when the statue of San Juditas shows him carrying his staff in his left hand, it means he's working for the drug traffickers, and nonsense like that." Father Jesús prefers to focus on the many new worshippers of true piety.

ON THE FACE OF IT, Mexican traffickers are the only ones who have no reason to feel desperate in the crisis currently obsessing their compatriots. Mexican traffickers, who are ideally placed to ship nearly all the cocaine consumed north of the border, also grow and smuggle much of the marijuana and an increasing percentage of the chemical stimulants U.S. consumers favor. They use violence as a particularly effective means of communication, disfiguring their victims horribly and displaying their corpses for all to see, so that everyone will know how powerful the drug lords are and fear them.

Once ■ small group of country folk knit together by family relationships, the original traders hailed mostly from the small northern Mexican state of Sinaloa. Sandwiched between the Gulf of California and the Sierra Madre




In Tijuana ■ man visits a modest roadside chapel (left) honoring the folk saint Jesús Malverde, a legendary outlaw said to have been hanged by officials in Sinaloa a century ago. Sinaloan drug traffickers adopted Malverde as a Robin Hood-like symbol of honorable thievery. Worshippers come to his main shrine in Culiacán (above) to pray and leave votive offerings.

Occidental, at least 300 miles from the U.S. border, and largely agricultural and poor, Sinaloa was an ideal location for a clandestine trade catering to the U.S. market. The early traffickers' operations were restricted largely to growing marijuana in the mountains or buying it from other growers along the Pacific coast, then smuggling it into the U.S. for a neat profit. For decades this was a comparatively low-risk and low-volume operation, and violence was contained within the drug world.

In the 1970s the Mexican government, in coordination with the U.S., carried out a series of offensives against the Sinaloa traffickers. It was like trying to get rid of a virus by flushing it into the bloodstream. A number of drug "foot soldiers," as they were beginning to be called, were imprisoned or killed, but most of their leaders escaped Sinaloa unharmed and set up operations in neighboring states and in the major cities along the U.S.-Mexico border. With every new military offensive, the traffickers slipped into a new region and became stronger. As the stakes

grew, so did armaments and the number of traffickers, and in each new city and region they bought off more politicians and police. There was no stopping the drug trade itself, because it was run according to a perfect formula: Sell illegal goods at a huge markup to consumers with money, and recruit your labor force primarily among young men with no money and no future, who are desperate to look sharp, act tough, and feel powerful. By the 1980s a new order was in place. The drug lords controlled the underworld and key members of the security forces in cities like Guadalajara, Tijuana, and Juárez. In a shaky peacekeeping arrangement that nevertheless lasted for years, the drug lords parceled out each city to a particular family.

In the 1990s the fragile peace among the displaced Sinaloa families broke down. They fought each other for control of the major border transit points and then began fighting sometimes with, and sometimes against, an upstart trafficking group with no Sinaloa connections. This was the self-styled Cartel del Golfo, from



In a prayer to La Santa Muerte at his private altar in Tepito, merchant Luis Demetrio Pérez Díaz blows smoke clouds redolent of indigenous American rituals. Scholars debate the death saint's origins—Mesoamerican, European, or both?





The new era had arrived, and the foot soldiers in the escalated drug wars, facing the prospect of a terrible death, increasingly turned to death itself for protection.

the Gulf coast state of Tamaulipas. An offshoot of this group was the Zetas, a band of rogue military personnel originally trained as elite antinarcotics forces. Ordinary Mexicans had their first inkling of how much more brutal the drug violence was going to be in September 2006, when a group of men dressed in black walked into a roadside discotheque in the state of Michoacán and dumped the contents of a plastic garbage bag on the floor. Five severed heads came rolling out.

THE NEW ERA had arrived, and the foot soldiers in the escalated drug wars, facing the prospect of such a terrible death, increasingly turned to death itself for protection. It was during the

first antidrug campaigns that the myth of Jesús Malverde, the original narco-saint, spread beyond the borders of Sinaloa. According to legend, Malverde was a 19th-century outlaw who robbed from the rich and gave to the poor, was hanged for his sins, and then worked miracles from the grave. His cult took off in the 1970s, after a former street vendor, Eligio González, began praying to him. Sitting outside the Malverde shrine in Culiacán, González's sturdy, relaxed, and unsmiling young son, Jesús, told me the story of the miracle. Eligio had been working as a driver in 1976 when he was knifed and shot in a holdup and left for dead. He prayed to Malverde, whose only monument at the time was a pile of rocks where his grave was said to be, promising to erect a proper shrine in Malverde's honor if the saintly bandit saved his life. When he survived, he kept his word.

González appears to have understood that people would grasp Malverde's real importance only if there were an image of him they could worship, but unfortunately no photograph of Malverde existed—and, in fact, no evidence at all that he'd ever lived. In the 1980s González asked an artisan in the neighborhood to create a plaster bust: "Make him sort of like Pedro Infante and sort of like Carlos Mariscal," Infante



Outside ■ Mexico City church that holds monthly festivals, or *romerías*, honoring St. Jude, young people (left) huff solvents. After an ambush at a shopping mall in Ciudad Juárez, a driver (above) and two passengers joined more than 2,600 murder victims last year in a city where drug-related killings have become terrifyingly commonplace.

being a famous movie star from Sinaloa and Mariscal a local politician.

The Malverde shrine is a makeshift cinder-block temple directly in front of the Sinaloa state government office complex, and its green walls are covered, inside and out, with testimonials left by the faithful. The plaster bust is enshrined in a glass case and surrounded by dozens of flower bouquets, mostly plastic. Many accompanying photographs and engraved plaques feature the image of a marijuana plant or a “goat horn”: an AK-47 rifle. No one seriously disputes Malverde’s status as a narco-saint—in Sinaloa it is stated as fact that whenever a major trafficker wants to pray, the entire street is closed down so he can worship in peace. But as a warden of the Culiacán prison pointed out, Malverde is now so popular among Sinaloans in every walk of life that he is really more of an identity symbol.

IN MEXICO CITY the director of penitentiaries refuses admission to reporters unwilling to sign a statement promising that they will not write

“propaganda” in favor of the cult of La Santa Muerte. At the Center for Enforcement of the Legal Consequences of Crime, on the other hand, the director of the prison lets me talk without preconditions to some of the prisoners about their faith. Escorted by the prison guards past a series of checkpoints and corridors, I am startled to end up in a long open-air corridor whose left wall has been decorated with cheerful cartoon images of Snow White, Tweety Bird, SpongeBob SquarePants, and the like. These were painted at the prisoners’ request, a guard explains, so that children might feel less terrified when they came to spend the holidays with their fathers. Facing the cartoon wall is a high wire fence and behind it, a collection of hangarlike buildings surrounded by grass and even a few trees.

This is where Antonio, the accused kidnapper, writes *corridos*, or outlaw songs, a couple of which have even been recorded. And where El Niño, the convicted murderer, sticks pins into black velvet and winds brightly colored threads

She is there after all the friends you thought you had have forgotten your very name. This guardian of the worst of sinners is La Santa Muerte, Holy Death.

around them in elaborate patterns to frame cutout images of the Virgin of Guadalupe, Jesus Christ, and La Santa Muerte. He first learned of Holy Death through television, which might seem a strange source for such a spiritual revelation, but it was the path open to him behind his wire enclosure. Now nothing can break his faith in his new protector.

We talk in the shade of a leafy tree in the prison yard, several of us sitting around a rickety table a couple of prisoners have brought out and carefully rubbed clean. A host of other inmates who initially had closed looming around us eventually stand quietly, nodding in agreement as Antonio explains what gives La Santa Muerte her powerful attraction: “La Muerte is always beside you—even if it’s just a little postage stamp that you put up above your cot, you know that she’s not going to move, that she’ll never leave.”

El Niño’s grandmother has told him that if he ever gets out of jail, she doesn’t want to see him, and she doesn’t want his daughter to see him again, ever. But unlike his flesh and blood, La Muerte needs him: “If you promise her a white flower, and you don’t bring it to her, you feel bad,” he says. “She weeps, and so you feel bad.” And therefore he makes promises to her that he keeps.

Midday approaches, and the heat is rising fast. The men nudge each other, and one goes off to fetch a cracked plastic jug of water, which he serves with unexpected courtesy to the unusual guest. I ask about rumors flying around that the rituals for La Santa—the Santísima, the Little Skinny One, the White Child—involve human blood and even human sacrifice. A prisoner in another facility, where conditions were infinitely worse, had told me that this was true.

El Niño and Antonio say just that La Santa



Muerte will grant your prayers—but only in exchange for payment, and that payment must be proportional to the size of the miracle requested, and the punishment for not meeting one’s debt to her is terrible.

The men and I have been in conversation for a while, and despite temperatures that must be turning their cell blocks into furnaces, there is something about the openness of the prison, the grass, the trees, even the comradely way the inmates treat the lone guard on duty, that makes the place seem almost pleasant. (“He spends 12 hours a day here,” Antonio says. “He’s as much a prisoner as we are.”)



A woman sprinkles lime to absorb blood from another Juárez drug murder. For families trying to live normally here, such measures can't hide the reality: Violent death is everywhere. Meanwhile, traffickers jockeying to feed the U.S. appetite for drugs seek solace in narco-saints, who symbolize the hope of a holy death after a brutal life.

As the men relax, their courteous ways with me even make it possible to imagine that they are not guilty of terrible crimes, that their faith in La Santa Muerte is merely a matter of preference and not born of desperate need. Then I ask El Niño if he thinks that when he gets out, it will be possible to lead a normal life.

His face twists into a bitter smile. "With everything I've done?" he says. "There's going to be people waiting to take me down the moment I walk outside the gate." We shake hands, and he and Antonio thank me for the chance to talk. I return to the other Mexico, where hope also requires a great deal of faith. □





The Secrets of
SLEEP

*From birth, we spend a third of
our lives asleep. After decades of research,
we're still not sure why.*

By D. T. Max

Photographs by Maggie Steber

CHERYL DINGES IS A 29-YEAR-OLD

Army sergeant from St. Louis. Her job is to train soldiers in hand-to-hand combat. Specializing in Brazilian jujitsu, Dinges says she is one of the few women in the Army certified at level 2 combat. Level 2 involves a lot of training with two attackers on one, she explains, with the hope of “you being the one guy getting out alive.”

Dinges may face an even harder fight in the years ahead. She belongs to a family carrying the gene for fatal familial insomnia. The main symptom of FFI, as the disease is often called, is the inability to sleep. First the ability to nap disappears, then the ability to get a full night's sleep, until the patient cannot sleep at all. The syndrome usually strikes when the sufferer is in his or her 50s, ordinarily lasts about a year, and, as the name indicates, always ends in death. Dinges has declined to be tested for the gene. “I was afraid that if I knew that this was something I had, I would not try as hard in life. I would allow myself to give up.”

FFI is an awful disease, made even worse by the fact that we know so little about how it works. After years of study, researchers have figured out that in a patient with FFI, malformed proteins called prions attack the sufferer's thalamus, a structure deep in the brain, and that a damaged thalamus interferes with sleep. But they don't know why this happens, or how to stop it, or ease

its brutal symptoms. Before FFI was investigated, most researchers didn't even know the thalamus had anything to do with sleep. FFI is exceedingly rare, known in only 40 families worldwide. But in one respect, it's a lot like the less serious kinds of insomnia plaguing millions of people today: It's pretty much a mystery.

IF WE DON'T KNOW WHY we can't sleep, it's in part because we don't really know why we need to sleep in the first place. We know we miss it if we don't have it. And we know that no matter how much we try to resist it, sleep conquers us in the end. We know that seven to nine hours after giving in to sleep, most of us are ready to get up again, and 15 to 17 hours after that we are tired once more. We have known for 50 years that we divide our slumber between periods of deep-wave sleep and what is called rapid eye movement (REM) sleep, when the brain is as active as when we're awake, but our voluntary muscles are paralyzed. We know that all mammals and birds sleep. A dolphin sleeps with half its brain awake so it can remain aware of its underwater environment. When mallard ducks sleep in a line, the two outermost birds are able to keep half of their brains alert and one eye open to guard against predators. Fish, reptiles, and insects all experience some kind of repose too.

All this downtime comes at a price. An animal must lie still for a great stretch of time, during which it is easy prey for predators. What can possibly be the payback for such risk? “If sleep

D. T. Max's book, The Family That Couldn't Sleep, explores the mystery of fatal familial insomnia. Maggie Steber photographed the story on memory in the November 2007 issue of Geographic.



doesn't serve an absolutely vital function," the renowned sleep researcher Allan Rechtschaffen once said, "it is the greatest mistake evolution ever made."

The predominant theory of sleep is that the brain demands it. This idea derives in part from common sense—whose head doesn't feel clearer after a good night's sleep? But the trick is to confirm this assumption with real data. How does sleeping help the brain? The answer may depend on what kind of sleep you are talking about. Recently, researchers at Harvard led by Robert Stickgold tested undergraduates on various aptitude tests, allowed them to nap, then tested them again. They found that those who had engaged in REM sleep subsequently performed better in pattern recognition tasks, such as grammar, while those who slept deeply were better at memorization. Other researchers have found that the sleeping brain appears to repeat a pattern of neuron firing that occurred while the subject was recently awake, as if in sleep the brain were trying to commit to long-term memory what it had learned that day.

The genetic history of sisters Carolyn Schear (at right) and Cheryl Dinges puts them at risk for fatal familial insomnia, a deadly inability to sleep. Schear learned she doesn't carry the gene. Dinges declined testing. "Why let the knowledge rule your life?"

Such studies suggest that memory consolidation may be one function of sleep. Giulio Tononi, a noted sleep researcher at the University of Wisconsin, Madison, published an interesting twist on this theory a few years ago: His study showed that the sleeping brain seems to weed out redundant or unnecessary synapses or connections. So the purpose of sleep may be to help us remember what's important, by letting us forget what's not.

Sleep is likely to have physiological purposes too: That patients with FFI never live long is likely significant. A lot of interest has focused on what exactly kills them, but we still don't know. Do they literally die from lack of sleep? And if not, to what extent does sleeplessness contribute



CHILD SLEEP

The proportion of time spent in REM, or dream, sleep declines from 50 percent in infancy to 25 percent in toddlers.

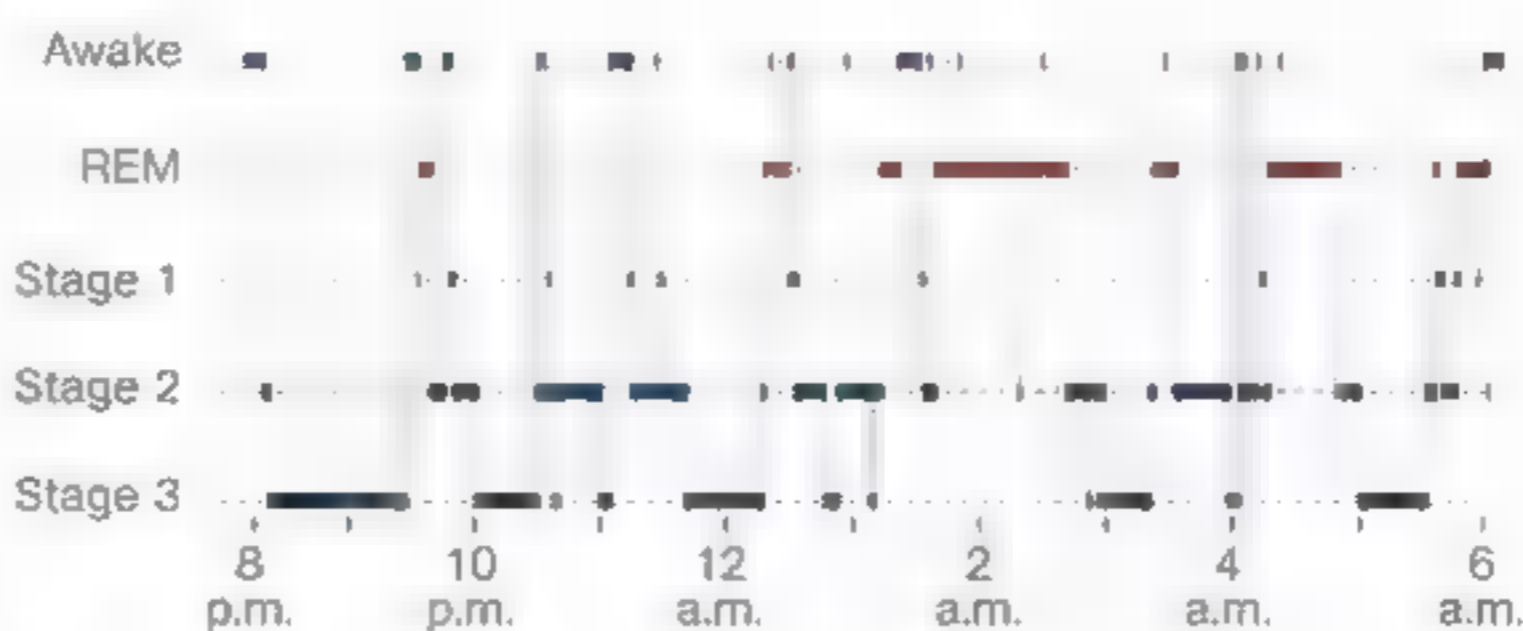
Sleep terrors peak during preschool years.

Children who get less sleep are at greater risk of becoming overweight.

Daytime sleepiness in school-age children could be an early sign of approaching puberty.

Sisters (clockwise from top)

Alexis Johnson, 5, Frederika Wright, 8, Amelia Johnson, 3, and Connie Johnson, 4, share a nap in their home in Miami, Florida.



ELECTRICAL BRAIN ACTIVITY ■ A THREE-YEAR-OLD GIRL REVEALS A RAPID DESCENT AT BEDTIME INTO DEEP STAGE 3 SLEEP. MOST DREAMS OCCUR IN REM SLEEP.



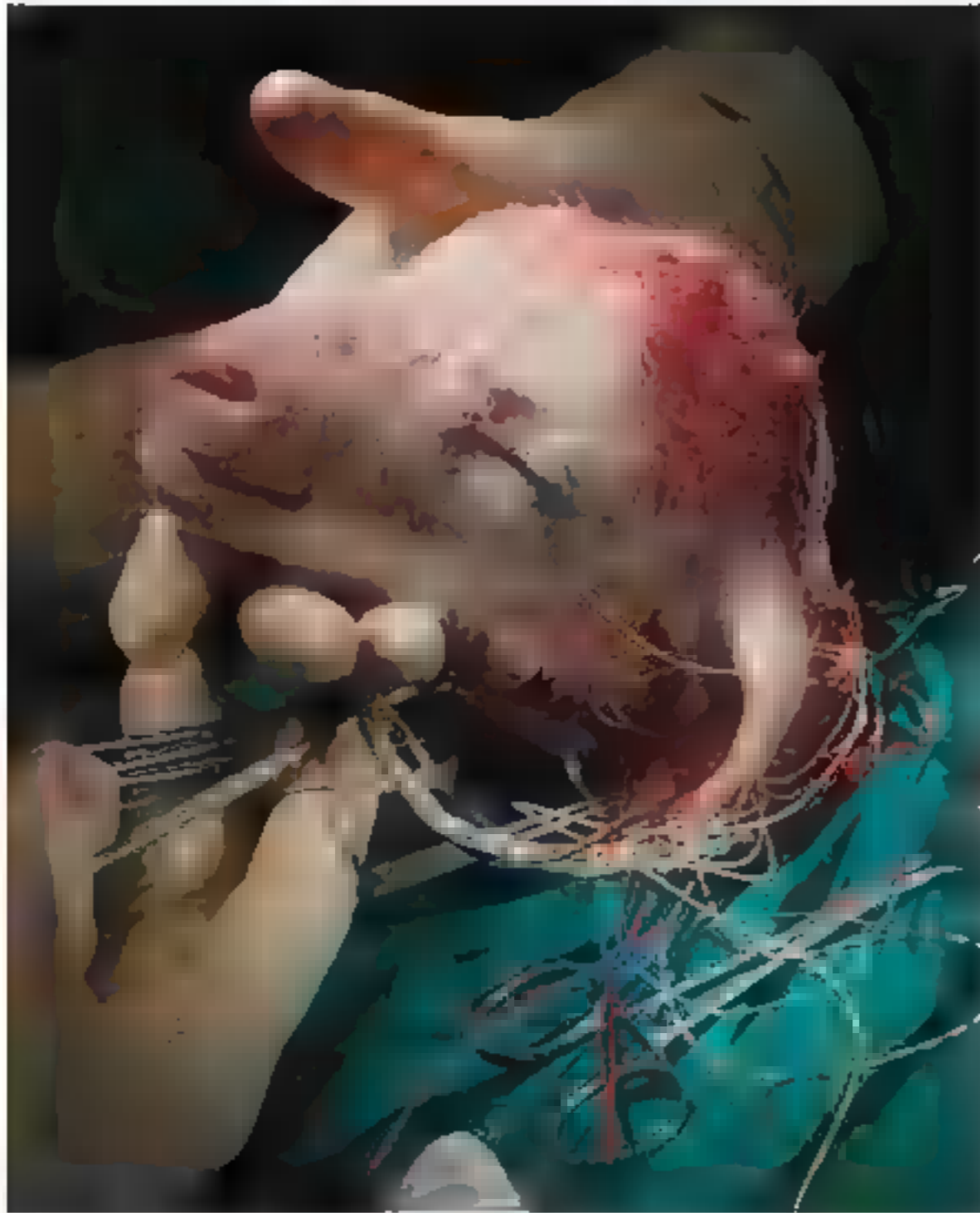
to the conditions that kill them? Some researchers have found that sleep deprivation impedes wound healing in rats, and others have suggested that sleep helps boost the immune system and control infection. But these studies are not conclusive.

In the most famous attempt to figure out why we sleep, in the 1980s, Rechtschaffen forced rats to stay awake in his University of Chicago lab by placing them on a disk suspended on a spindle over a tank of water. If the rats fell asleep, the disk would turn and throw them in the water; when they fell into the water, they immediately woke up. After about two weeks of this strict enforcement of sleeplessness, all the rats were dead. But when Rechtschaffen performed necropsies on the animals, he could not find anything significantly wrong with them. Their organs

were not damaged; they appeared to have died from exhaustion—that is, from not sleeping. A follow-up experiment in 2002, with more sophisticated instruments, again failed to find “an unambiguous cause of death” in the rats.

At Stanford University I visited William Dement, the retired dean of sleep studies, a co-discoverer of REM sleep, and co-founder of the Stanford Sleep Medicine Center. I asked him to tell me what he knew, after 50 years of research, about the reason we sleep. “As far as I know,” he answered, “the only reason we need to sleep that is really, really solid is because we get sleepy.”

UNFORTUNATELY, THE REVERSE is not always true; we don’t always get sleepy when we need to sleep. Insomnia is at epidemic levels in the developed world. Fifty to 75 million Americans,



Lamb brains develop in utero on a course similar to human brains, allowing Matthias Schwab of Friedrich Schiller University, Germany, to use sheep as a window into prenatal sleep. He attaches electrodes to a fetal lamb's brain (above) and returns it to the womb for monitoring (left). His research suggests that fetal slumber is predominantly deep sleep, not REM sleep as once thought.

roughly a fifth of the population, complain about problems sleeping. Fifty-six million prescriptions for sleeping pills were written in 2008, up 54 percent over the previous four years. The revenue for sleep centers is expected to approach four and a half billion dollars by 2011. Yet remarkably little is being done to understand the root causes of insomnia. Most medical school students get no more than four hours of training on sleep disorders; some get none. Family doctors' health questionnaires often don't even ask about sleep.

The social and economic costs from the undertreatment of sleeplessness are huge. The Institute of Medicine, an independent national scientific advisory group, estimates nearly 20 percent of all serious motor vehicle accidents are associated with driver sleepiness. It places the direct medical cost of our collective sleep

debt at tens of billions of dollars. The loss in terms of work productivity are even higher. Then there are the softer costs—the damaged or lost relationships, the jobs tired people don't have the energy to apply for, the muting of enjoyment in life's pleasures.

If a medical problem in some less private, less mysterious bodily function were causing such widespread harm, governments would declare war on it. But the National Institutes of Health contributes only about \$230 million a year to sleep research—comparable to the amount that the manufacturers of the popular sleeping pills Lunesta and Ambien spent in one season on television advertising in 2008. The military also spends money investigating sleep, but its primary mission is keeping soldiers up and ready to fight, not ensuring they get a good night's rest. As a result the fight against insomnia is largely left to drug companies and commercial sleep centers.

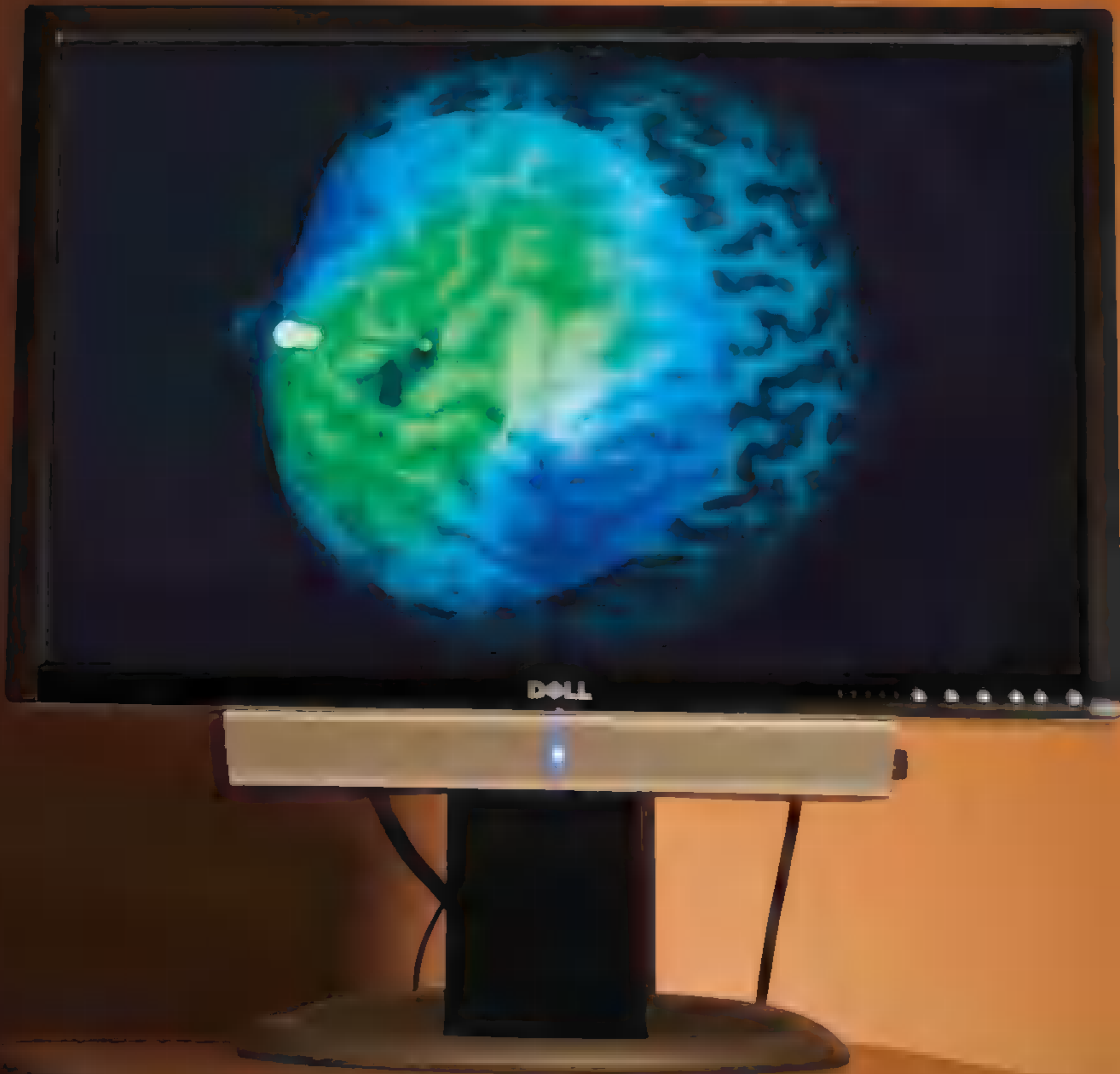
"Sleep has been the Rodney Dangerfield of medicine," says John Winkelman, medical director of the Brigham and Women's Hospital's Sleep Health Center in Brighton, Massachusetts. "It just gets no respect."

ONE EARLY AFTERNOON last year I paid a visit to the Sleep Medicine Center at Stanford. The clinic, founded in 1970, was the first in the country devoted to the problem of insomnia, and it remains among the most important. The sleep center sees over 10,000 patients a year and does more than 3,000 overnight sleep studies. The 18 bedrooms that patients occupy looked comfortable, the beds soft and cozy. The monitoring equipment was hidden in the furniture.

The main diagnostic tool at the clinic is the polysomnogram, the main element of which is the electroencephalograph (EEG), which captures the electrical output from a sleeping patient's brain. As you fall asleep, your brain slows down, and its electrical signature changes from short jagged waves to longer rolling ones, much the way the movement of the sea smooths out the farther you get from shore. In the brain these gentle undulations are interrupted periodically by a renewal of the sudden agitated mental



*What separates sleep from consciousness?
University of Wisconsin, Madison, researcher
Simone Sarasso demonstrates a device that probes
the question — inducing slow brain waves in
sleeping patients. The technique, called transcranial
magnetic stimulation, may also help restore
deep sleep to patients with sleep disorders.*

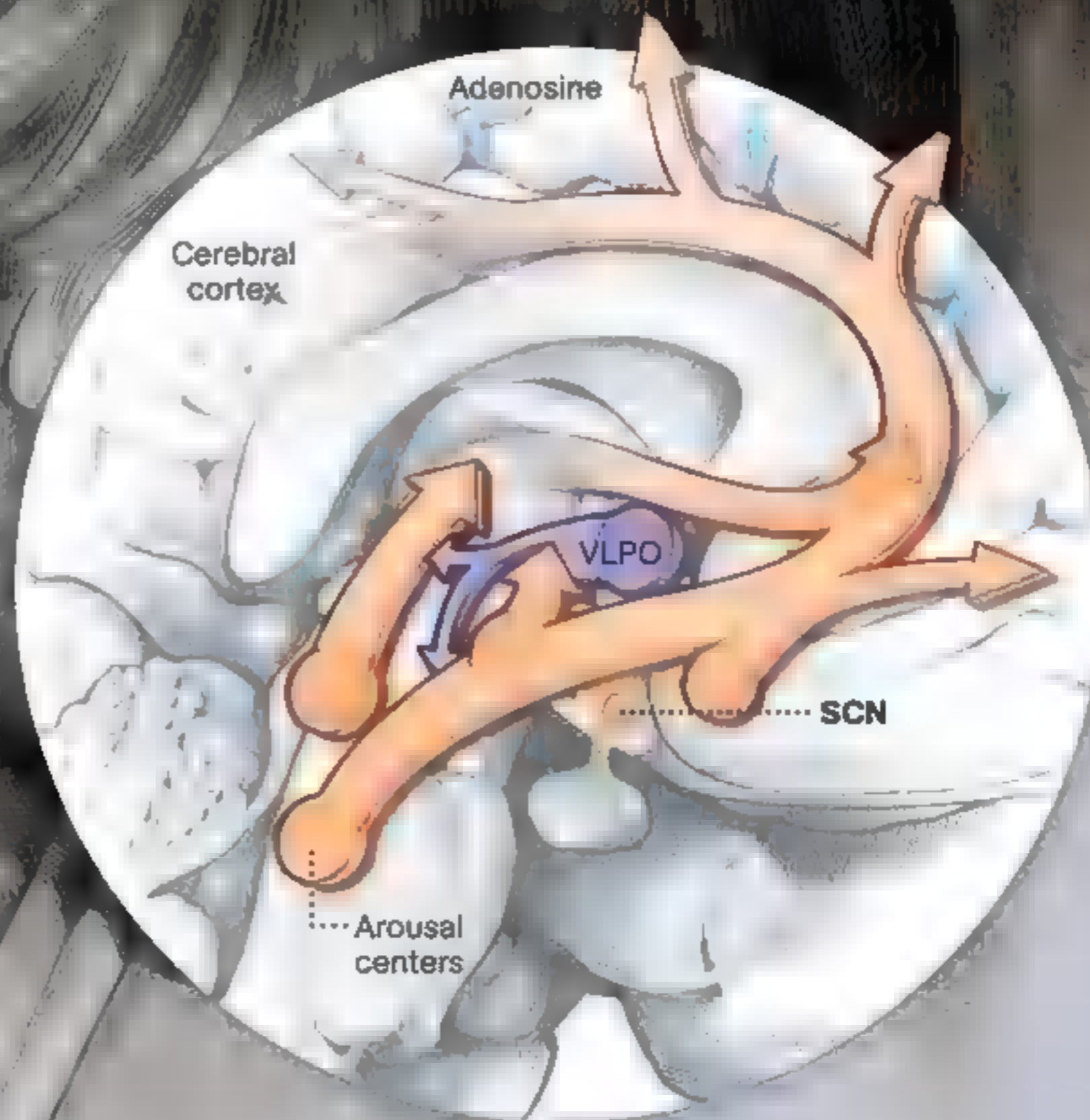
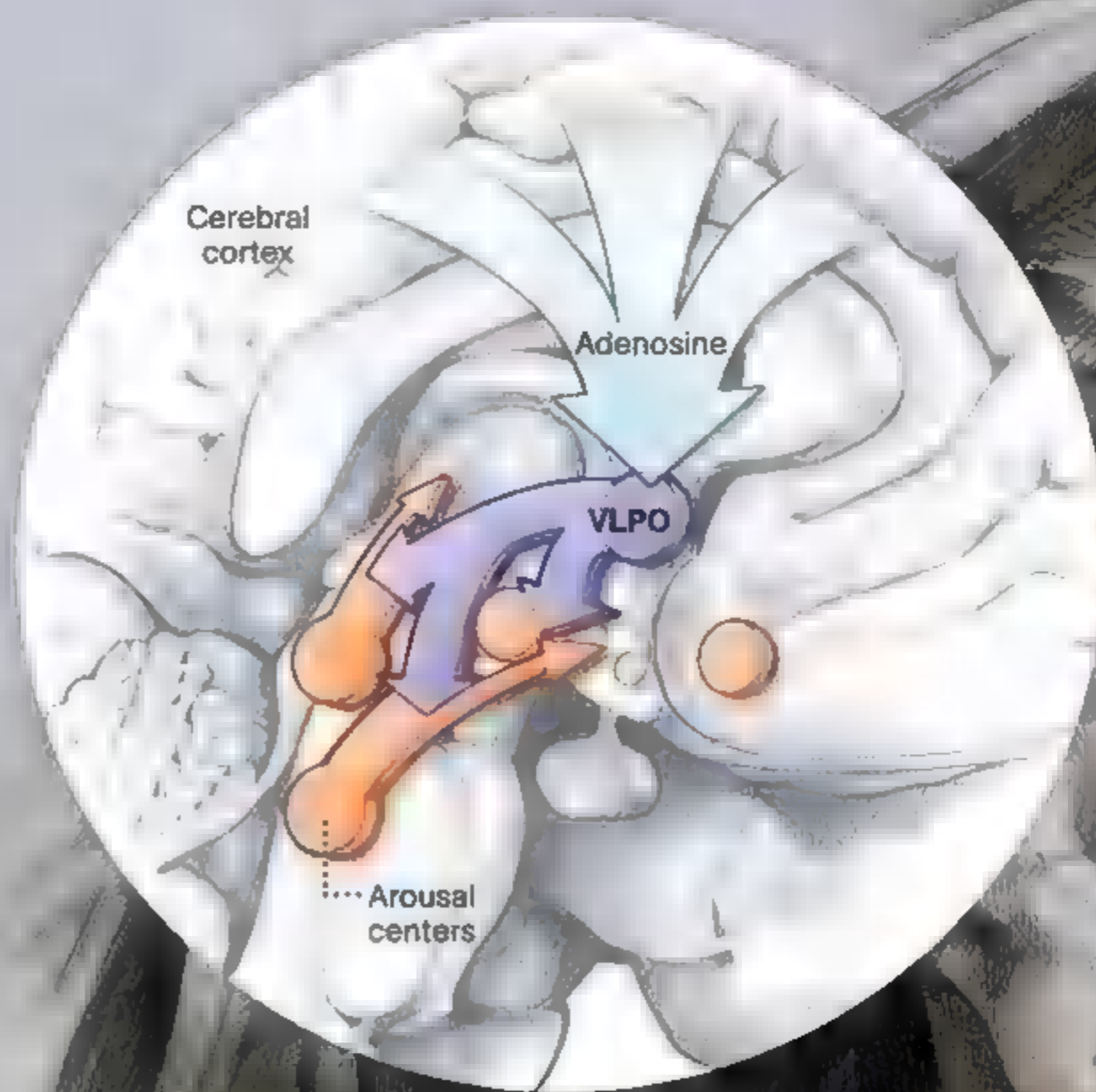


THE BRAIN IN SLUMBER

Sleep is no longer thought of as merely the time we spend unconscious. It is a dynamic state characterized by shifting levels of electrical activity and the ebb and flow of chemicals into various regions of the brain. Key to this give-and-take are two tiny structures in the hypothalamus deep in the brain. The neural dance they engage in determines when we fall asleep, and when we wake again to face the day.

FALLING ASLEEP

Sleep depends on a pinhead-size cluster of cells called the ventrolateral preoptic nucleus (VLPO). Triggered by the daily buildup of the chemical adenosine, the VLPO sends a signal to arousal centers to stop producing histamine and other chemicals that keep us alert.

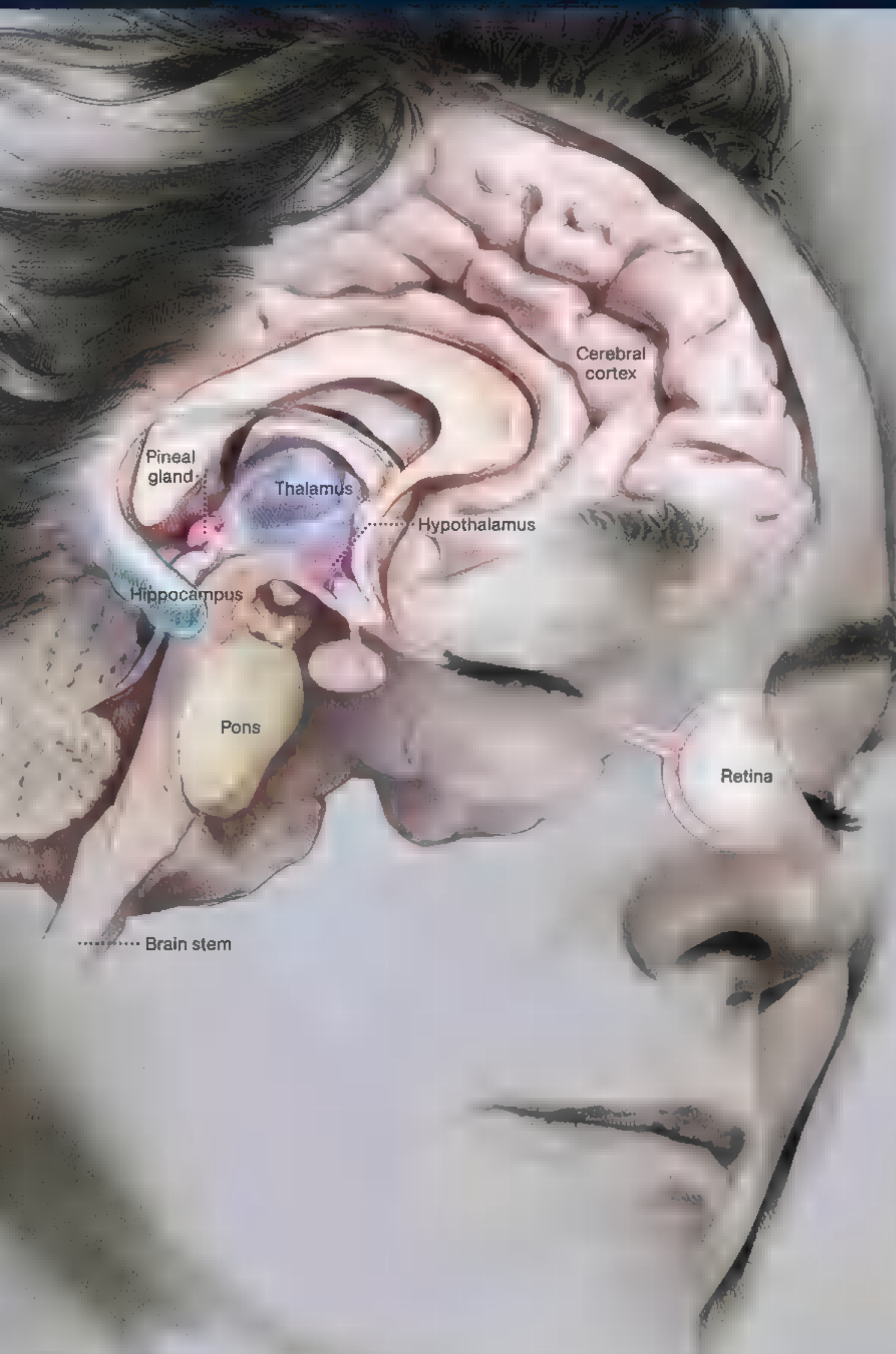


WAKING UP

Awakening is initiated by the body's master biological clock, located in another tiny cell cluster called the suprachiasmatic nucleus (SCN). Responding to light, the SCN generates a "wake-up" cue that signals the VLPO to stop firing, reactivating the arousal system.

HIRAM HENRIQUEZ AND ROBIN T. REID
ART: BRUCE MORSER

SOURCES: CLIFFORD B. SAPER, HARVARD MEDICAL SCHOOL;
TIMOTHY H. MONK AND ERIC A. NOFZINGER, UNIVERSITY OF
PITTSBURGH MEDICAL CENTER; CAROLE L. MARCUS,
UNIVERSITY OF PENNSYLVANIA



THE ANATOMY OF SLEEP

Hypothalamus: Critical to sleep; contains clusters of neurons that govern circadian rhythms and regulate chemicals promoting sleep and arousal

Thalamus: Blocks input from the senses, allowing the brain to focus on processing information from the day

Pineal gland: Produces melatonin when the body's clock senses darkness, helping the brain prepare for sleep

Hippocampus: Vital to memory formation; during REM sleep, replays memories to be stored

Pons: Involved in both arousal and the activation of dreams; during REM sleep, blocks signals to the spinal cord, preventing us from acting out our dreams

Cerebral cortex: Activated during REM sleep by signals from the pons; dreams may be the cortex's attempts to create a "story" out of information collected during waking hours

Retina: Contains special cells that send an arousal signal to the brain when they sense light

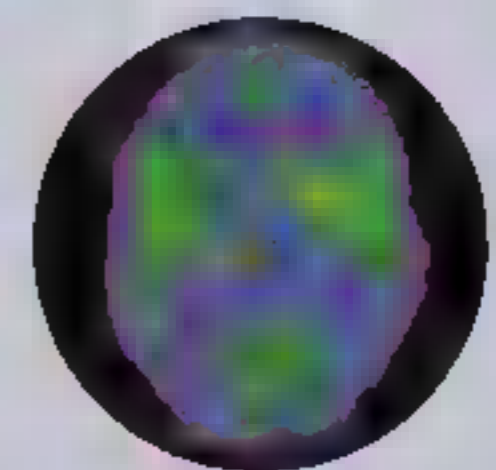
STAGES OF SLEEP

At night we cycle several times through ever deeper phases of sleep. In stage 1 (light sleep) we may drift in and out of wakefulness. Brain waves slow in stage 2, with occasional bursts of rapid waves. Stage 3 (split into 3 and 4 by some) is deep sleep, with extremely slow brain waves. More active periods of REM (rapid eye movement) sleep punctuate the stages: Heart rate and breathing grow more rapid; most dreams occur.

BRAIN ACTIVITY DURING SLEEP
High ■ ■ ■ ■ ■ ■ Low

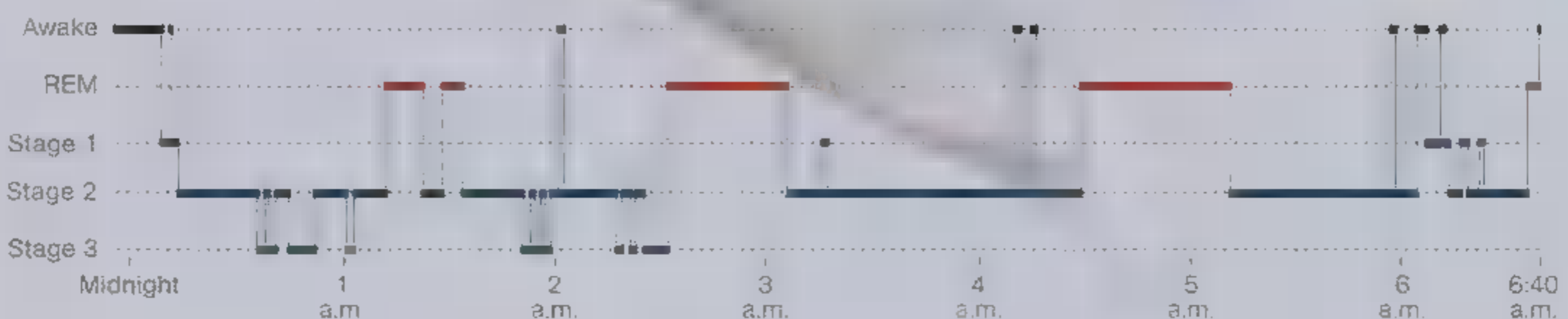


REM



Non-REM

Adult Sleep



activity of REM sleep. For unknown reasons, REM is the time during sleep when we do nearly all our dreaming.

As the EEG records this fitful voyage, the polysomnogram technicians also measure body temperature, muscle activity, eye movement, heart rhythms, and breathing. Then they look over the data for signs of abnormal sleep or frequent wake-ups. When a person has narcolepsy, for instance, he or she plunges from wakefulness into REM sleep without any intermediate steps. In fatal familial insomnia, the sufferer can never get past the first stages of sleep; body temperature soars and crashes.

FFI and narcolepsy cannot be diagnosed without EEGs and other monitoring devices. But Clete Kushida, the clinic director, told me he can spot most people's sleep problems right at the intake interview: There are those who cannot keep their eyes open, and those who just speak of their exhaustion but don't actually nod off. The former often have sleep apnea. The latter have what Kushida calls "true insomnia."

In obstructive sleep apnea sufferers, the muscle relaxation that comes with sleep allows the soft tissue of the throat and esophagus to close, shutting off the sleeper's air passage. When the brain realizes it is not getting oxygen, it sends an emergency signal to the body to wake up. The sleeper awakes, takes a breath, the brain is replenished, and sleep returns. A night's sleep for an apnea sufferer turns out to really be a hundred micro-naps. Sleep apnea is the behemoth of the sleep center business. Brigham and Women's John Winkelman says that at his sleep center, two-thirds of those examined are diagnosed with the condition.

Apnea is a serious problem, implicated in increased risk for heart attacks and stroke. But it is only indirectly a sleep disease. True insomniacs—people diagnosed with what some sleep doctors call psychophysiological insomnia—are people who either can't get to sleep or can't stay asleep for no evident reason. They wake up and don't feel rested. They lie down and their brains whir. This group makes up about 25 percent of those seen in sleep clinics, according to

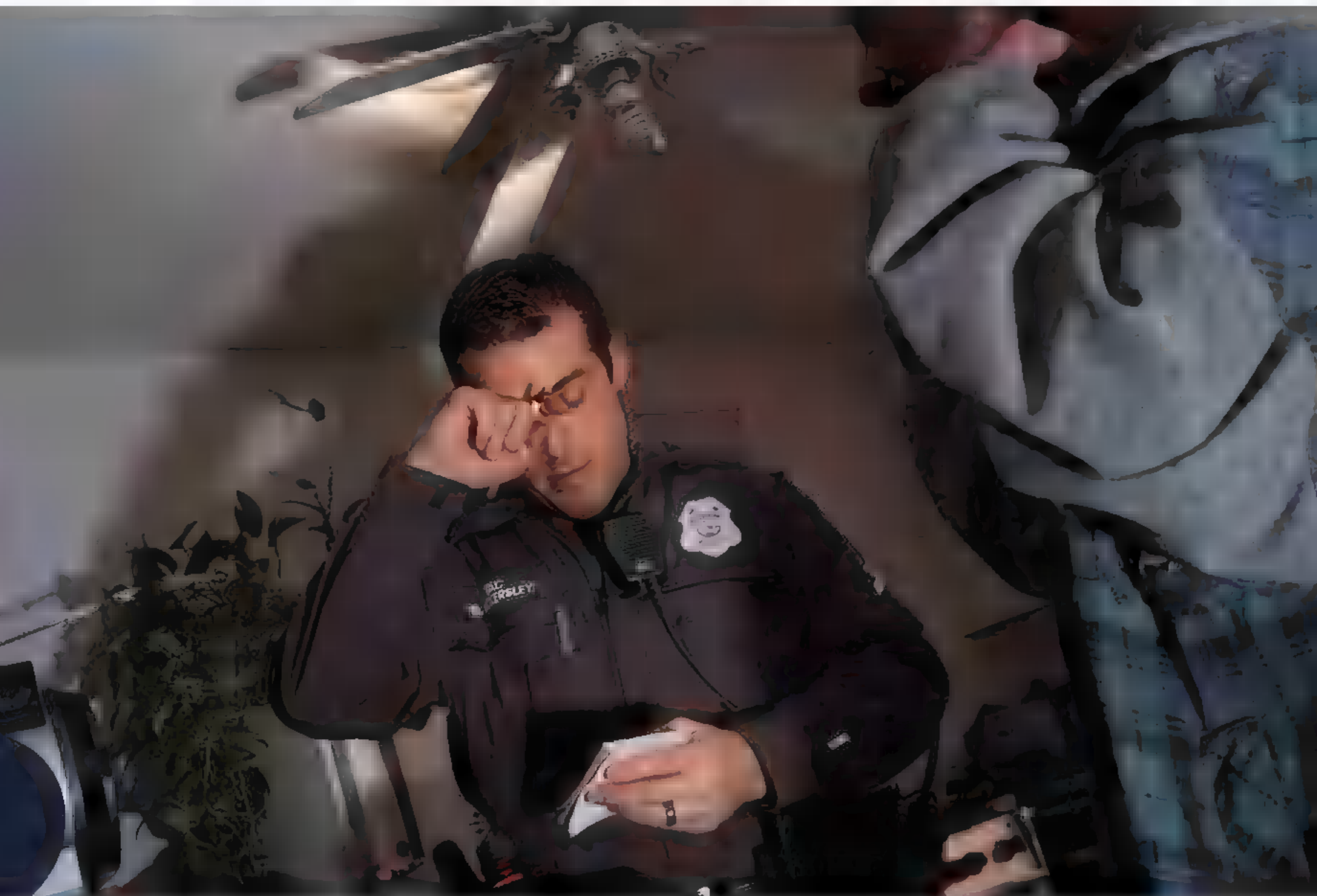
A hard night's day catches up with Officer Brian Eckersley, who works 4:30 p.m. to 3:10 a.m. for the Spokane Police Department. Sleep deprivation is insidious. Staying awake 24 hours causes an impairment equal to three shots of whiskey in one hour.

Winkelman. The Institute of Medicine estimates that over all, there are 30 million people with this condition in the United States.

While apnea can be treated with a device that forces air down the sleeper's throat to keep the airways open, the treatment of classic insomnia is not so clear-cut. Acupuncture may help—it has long had this role in Asian medicine and is being studied at the University of Pittsburgh sleep center now.

Typically, psychophysiological insomnia is treated with a two-part approach. First come the sleeping pills, most of which work by enhancing the activity of GABA, a neurotransmitter that regulates overall anxiety and alertness in the body. Though safer than they once were, sleeping pills can lead to psychological addiction. Many users complain that their sleeping-pill sleep seems different, and they feel hungover when they wake up. "Sleeping pills are not a natural way to sleep," points out Charles Czeisler, director of the Harvard Work Hours, Health and Safety Group. Pills can make future insomnia worse, too, a drawback called rebound insomnia.

The second step in treating true insomniacs is usually cognitive behavioral therapy (CBT). In CBT, a specialized psychologist teaches the insomniac to think about his or her sleep problems as manageable, even solvable—that's the cognitive part—and to practice good "sleep hygiene." Good sleep hygiene mostly amounts to tried-and-true advice: Sleep in a dark room, go to bed only when you are sleepy, don't exercise before bed. Studies have shown that CBT is more effective than sleeping pills at treating long-term insomnia, but many sufferers aren't convinced. "Some people continue in my experience to struggle," says Winkelman. "They're not super-satisfied with their sleep."



Winkelman thinks CBT is better at helping some kinds of insomniacs than others. Insomnia covers a multitude of conditions. Between FFI, which is extremely rare, and apnea, which is very common, there are almost 90 recognized sleep disorders and a host of harder to codify reasons people can't sleep. Some insomniacs suffer from restless legs syndrome (RLS), an intense discomfort in their limbs that prevents falling asleep, or periodic limb movement disorder (PLMD), which produces involuntary kicking during sleep. Narcoleptics often have difficulty both staying asleep and staying awake. Then there are people who can't sleep because of depression, and people who are depressed because they can't sleep. Others have problems sleeping because of dementia or Alzheimer's disease. Some women sleep badly during their

periods (women are twice as likely to have insomnia as men) and many during menopause. Older people in general sleep less well than young. Some insomniacs can't sleep because they are on medications that keep them awake. Others are worrying about work or soon having no work; one-third of Americans report they have lost sleep in the recent economic crisis. Of all these non-sleepers, patients with insomnia derived from physical internal causes—probably excesses or scarcities of various neurotransmitters—are likely the ones least able to respond to the treatment.

Yet for most of these conditions, CBT is offered as a potential cure. Perhaps this is because the problem of insomnia was for a long time the purview mainly of psychologists. In their eyes, insomnia is generally caused by something

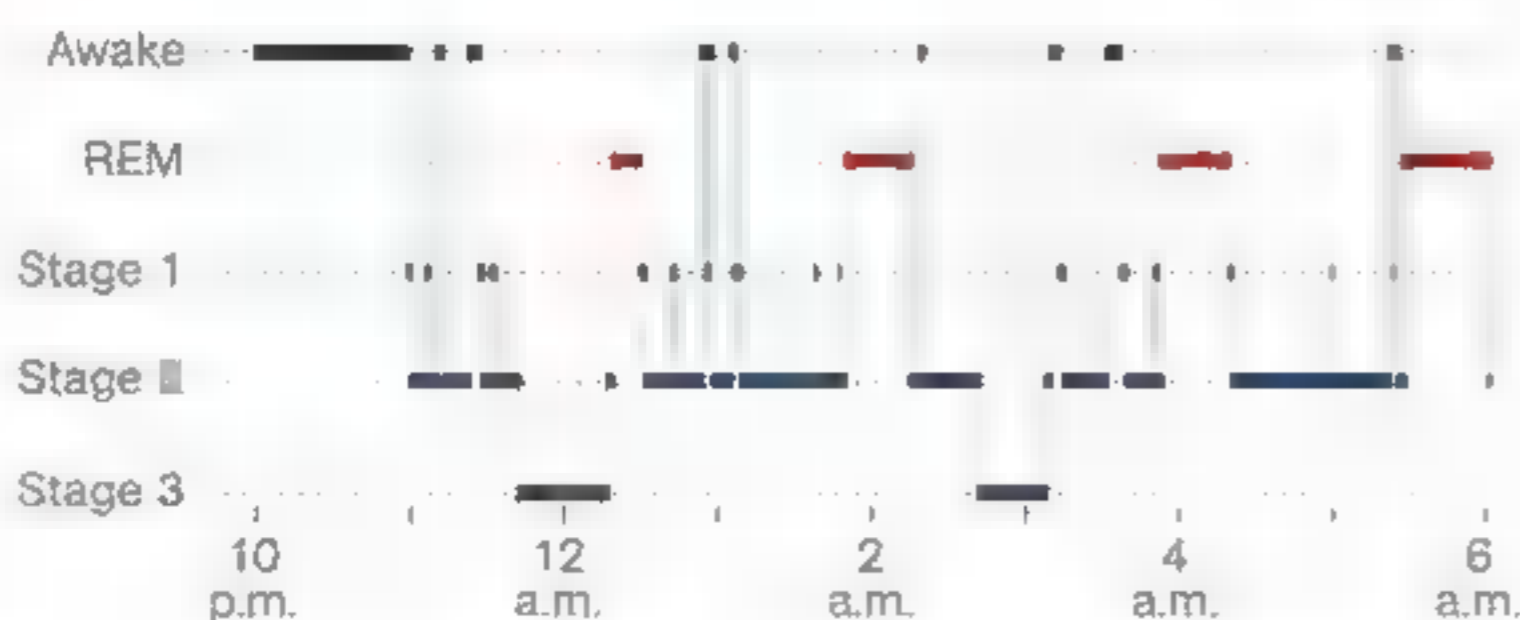
ADOLESCENT SLEEP

Only one in five teenagers gets the optimal nine hours of sleep on school nights.

High school students who report earning C's or lower get less sleep than those reporting higher grades.

Teens naturally get sleepy later at night and wake up later, putting them at odds with early school times.

Blaine Eggemeyer, 15, of Festus, Missouri, sleeps late on a Saturday morning, after a football game the night before. "He needs his ten hours," says his mother, Cindi.



BRAIN ACTIVITY OF A 14-YEAR-OLD GIRL REVEALS AN ADOLESCENT DILEMMA: DIFFICULTY FALLING ASLEEP, AND WAKING UP, AT PRESCRIBED TIMES.





treatable through their tool kit, usually anxiety or depression. By extension, cognitive behavioral therapy asks the sleeper to think about what he or she is doing wrong, not what is wrong with his or her body. Winkelman wishes that the two aspects of sleep—the physical and the mental—were more often considered jointly. “Sleep is extraordinarily complicated,” he says. “Why would we think that there couldn’t be something in the wiring that goes awry too?”

IF WE CAN’T SLEEP, perhaps it’s because we’ve forgotten how. In premodern times people slept differently, going to bed at sunset and rising with the dawn. In winter months, with so long to rest, our ancestors may have broken sleep up into chunks. In developing countries people still often sleep this way. They bed down in groups and get up from time to time during the night.

Cells in the retina use light to set the brain’s circadian clock. Studies at Brigham and Women’s Hospital in Boston suggest blue light resets the clock most efficiently—holding promise for jet-lagged travelers and drowsy night shift workers.

Some sleep outside, where it is cooler and the effect of sunlight on our circadian rhythm is more direct. In 2002, Carol Worthman and Melissa Melby of Emory University published a comparative survey of how people sleep in a variety of cultures. They found that among foraging groups such as the !Kung and Efe, “the boundaries of sleep and waking are very fluid.” There is no fixed bedtime, and no one tells anyone else to go to sleep. Sleepers get up when a conversation or musical performance intrudes on their rest and intrigues them. They might join in, then nod off again.

No one in developed nations sleeps this way today, at least not on purpose. We go to bed near a fixed time, sleep alone or with our partner, on soft cushions covered with sheets and blankets. We sleep on average about an hour and a half less a night than we did just a century ago. Some of our epidemic of insomnia or sleeplessness is probably just our refusal to pay attention to our biology. The natural sleep rhythms of teenagers would call for a late morning wake-up—but there they are, starting high school at 8 a.m. The night shift worker sleeping in the morning is fighting ancient rhythms in his or her body that order him or her awake to hunt or forage when the sky is flooded with light. Yet he or she has no choice.

We fight these forces at our peril. In February 2009 a commuter jet en route from Newark to Buffalo crashed, killing all 49 aboard and one on the ground. The copilot, and probably the pilot, had only sporadic amounts of sleep the day leading up to the crash, leading the National Transportation Safety Board to conclude that their performance “was likely impaired because of fatigue.” This sort of news enrages Harvard’s Charles Czeisler. He notes that going without sleep for 24 hours or getting only five hours of

sleep a night for a week is the equivalent of a blood alcohol level of 0.1 percent. Yet modern business ethic celebrates such feats. “We would never say, ‘This person is a great worker! He’s drunk all the time!’” Czeisler wrote in a 2006 *Harvard Business Review* article.

Starting in 2004, Czeisler published a series of reports in medical journals based on a study his group had conducted of 2,700 first-year medical residents. These young men and women work shifts that are as long as 30 hours twice a week. Czeisler’s research revealed the remarkable public health risk that this sleep debt entailed. “We know that one out of five first-year residents admits to making a fatigue-related mistake that resulted in injury to a patient,” he told me in the spring of 2009. “One in 20 admits to making a fatigue-related mistake that resulted in the death of a patient.” When Czeisler came out with this information, he expected hospitals to thank him. Instead many “circled the wagons.” He despairs of anything being done until U.S. employers get serious about insomnia and sleepiness. “My conviction is that one day people will look back on what will be viewed as a barbarous practice.”

NOW CONSIDER THE SIESTA. The timing of the traditional siesta corresponds to a natural post-lunch dip in our circadian rhythms, and studies have shown that people who catnap are generally more productive and may even enjoy lower risk of death from heart disease. It is the Spanish who have made the siesta famous. Unfortunately, Spaniards no longer live close enough to work to go home and nap. Instead some use the afternoon break to go out for long lunches with friends and colleagues. Having spent two hours at lunch, Spanish workers then cannot finish work until seven or eight. But even then they don’t always go home. They go out for drinks or dinner instead. (Go to a Spanish disco at midnight and you’re likely to be dancing alone; their prime-time TV shows are just ending.)

Lately the Spanish have begun to take the problem of sleep deprivation seriously. The police now question drivers in serious accidents about how long they slept the night before,

and the government has recently mandated shorter hours for its employees to try to get them home earlier.

What has motivated the Spanish to take action against sleepiness is not so much their accident rate—historically among the highest in western Europe—as their flat productivity. The Spanish spend more time at work and their productivity is less than most of their European neighbors. “It’s one thing to log hours, another to get something done,” Ignacio Buqueras y Bach, a 68-year-old businessman who has spearheaded the attempt to get Spaniards to bed earlier, lectured his countrymen in a Madrid newspaper recently.

“Every once in a while we have to close our eyes,” Buqueras told me. “We’re not machines.”

In 2006 a commission formed by Buqueras to change things became part of the Spanish government. Two years later I had occasion to go to one of the commission’s meetings in the annex to the Congreso de los Diputados, the lower house of Spain’s legislative branch. An assortment of modern Spanish grandees testified to the problem. They spoke of accidents by tired workers, Spanish women doubly exhausted by long work hours and household duties, and small children deprived of their proper ten to twelve hours of sleep. Members were urged to contact the television networks to see if they would consider moving prime time earlier.

Buqueras kept the meeting moving, exhorting the speakers to adhere to a “telegraphic brevity.” But the lights were low and the room warm. In the audience a few participants’ heads began to slump to their chests, then pop back up as they resisted, then their eyes closed more fully, their programs lowering to their laps, as they began to pay back their nation’s sleep debt. □



Author D. T. Max probes deeper into the mysteries of sleep in *Explorer: Fatal Insomnia*, on the National Geographic Channel, April 27 at 10 p.m. ET/PT in the U.S.

Wake up and see how sleep differs around the world in an interactive graphic at ngm.com/sleep.

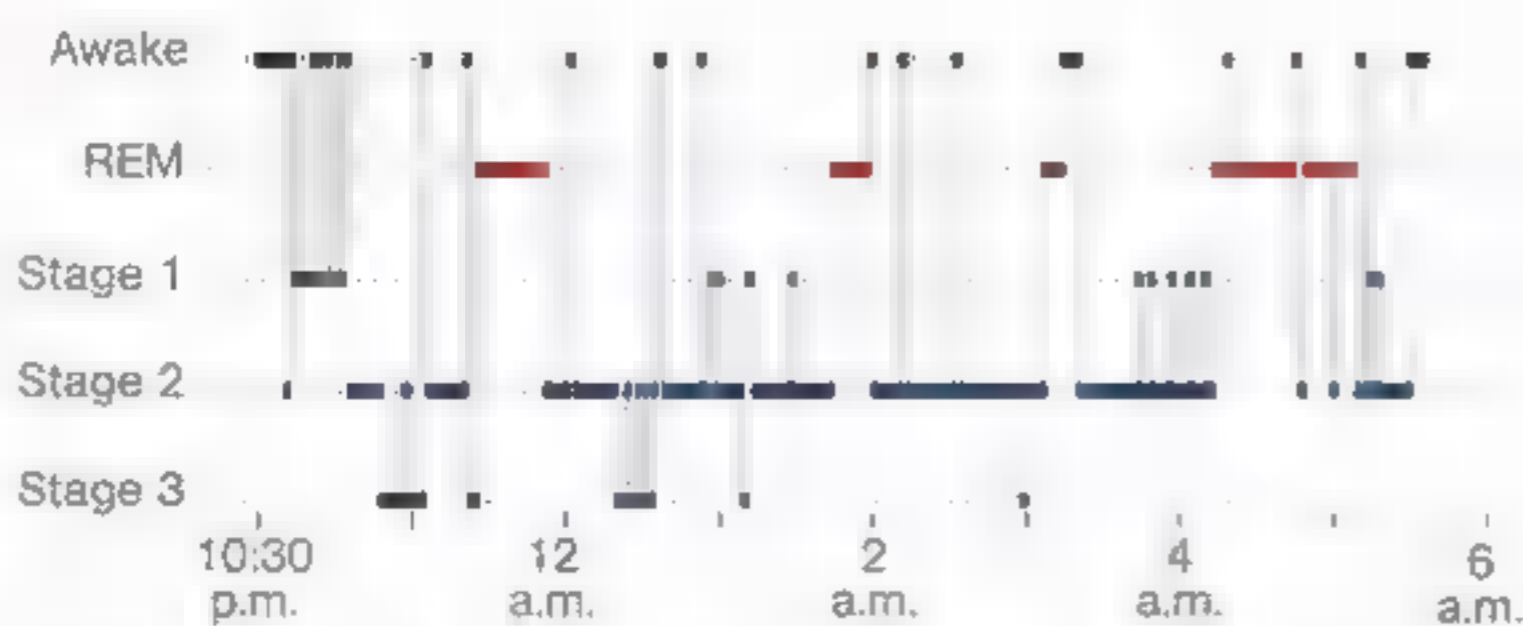
ELDER SLEEP

Older people get sleepy earlier and wake up earlier than younger adults, and may need a little less sleep to remain alert during the day.

Insomnia affects nearly half of adults 60 and older.

Elderly people who sleep as well as they did in middle age remain physically and mentally healthier.

Virginia Calzadilla, 89, naps for about a half hour after lunch every day at her assisted-living facility in Hollywood, Florida.



BRAIN ACTIVITY OF AN 89-YEAR-OLD FEMALE SHOWS FITFUL AWAKENINGS THROUGHOUT THE NIGHT, AND LESS TIME SPENT IN THE DEEP SLEEP OF STAGE 3.









*When tea was worth more than porcelain or silk, porters and pack animals
traveled up switchbacks to cross Tibet's 15,000-foot Zar Gama Pass as they followed the
Tea Horse Road. Today travelers climb the terraced route by car or truck.*

The Forgotten Road



Chinese tea and Tibetan horses were long traded on a legendary trail. Today remnants of the passageway reveal grand vistas—and a surprising new commerce.



At Shechen monastery in Sichuan Province, monks mix tea into tsampa, roasted barley flour, to make a meal. The tea, seasoned with salt and yak butter, is brewed from leaves sold in bricks such as this one marking the Year of the Horse (far left).





Careful fingers pinch the year's first—and best—crop of tea leaves in April at the Mingshan Ecological Tea Garden in Sichuan. Historians believe tea was first cultivated in the wet highlands of Sichuan and Yunnan.



D

Deep in the mountains of western Sichuan I'm hacking through a bamboo jungle, trying to find a legendary trail. Just 60 years ago, when much of Asia still moved by foot or hoof, the Tea Horse Road was a thoroughfare of commerce, the main link between China and Tibet. But my search could be in vain. A few days earlier I met a man who used to carry backbreaking loads of tea along the path; he warned me that time, weather, and invasive plants may have wiped out the Tea Horse Road. ¶ Then, with one wide sweep of my ax, the bamboo falls. Before me is a four-foot-wide cobblestone trail curving up through the forest, slick with green moss, almost overgrown. Some of the stones are pitted with water-filled divots, left by the metal-spiked

crutches used by hundreds of thousands of porters who trod this trail for a millennium.

The vestigial cobblestone path lasts only 50 feet, climbs a set of broken stairs, then once again disappears, swept away by years of monsoonal deluges. I carry on, entering a narrow passage where the sidewalls are so steep and slippery I have to hang on to trees to keep from falling into the bouldery creek far below. I'm hoping, at some point, to cross over Maan Shan, a high pass between Yaan and Kangding.

That night I camp high above the creek, but the wood is too wet to make a fire. Rain pounds the tent. In the morning I probe ahead another 500 yards before an impenetrable wall of jungle stops me, for good. I'm forced to admit that here at least the Tea Horse Road has vanished.

IN FACT, MOST OF THE ORIGINAL Tea Horse Road is gone. Recklessly rushing to modernity, China has been paving over its past as fast as possible. Before the trail is bulldozed or obliterated, I've come to explore what's left of this

once famous but now all-but-forgotten route.

The ancient passageway once stretched almost 1,400 miles across the chest of Cathay, from Yaan, in the tea-growing region of Sichuan Province, to Lhasa, the almost 12,000-foot-high capital of Tibet. One of the highest, harshest trails in Asia, it marched up out of China's verdant valleys, traversed the wind-stripped, snow-scoured Tibetan Plateau, forded the freezing Yangtze, Mekong, and Salween Rivers, sliced into the mysterious Nyainqentanglha Mountains, ascended four deadly 17,000-foot passes, and finally dropped into the holy Tibetan city.

Snowstorms often buried the western part of the trail, and torrential rains ravaged the eastern portion. Bandits were a constant threat. Yet the trail was heavily used for centuries, even though the cultures at either end at times despised each other (and still do). The desire to trade was why the trail existed, not the romantic swapping of ideas and ethics, culture and creativity associated with the legendary Silk Road to the north. China had something Tibet wanted: tea. Tibet had



In 1946 porters were still hauling 300-pound loads of bundled tea on the road to Tibet. Pausing every few hundred yards to rest their loads on walking crutches, the bearers needed three weeks to cover 140 miles between Yaan and Kangding. Then pack animals took over.

something China desperately needed: horses.

Today the trail lives on in the memories of men like Luo Yong Fu, a watery-eyed 92-year-old whom I met in the village of Changheba, a ten-day walk for a tea porter west of Yaan. When I first arrived in Sichuan, I was told no tea porters were still alive. But as I walked the last remnants of the Chamagudao, the Chinese name for the ancient trade route, I met not only Luo, but also five others, all eager to share their stories. Stooped but still surprisingly strong, Luo Yong Fu wore a black beret and a blue Mao jacket with a pipe in the pocket. He had worked on the Tea Horse Road as a porter, carrying tea to Tibet from 1935 to 1949. Luo's load of tea always weighed 135 pounds or more. At the time, he weighed less than 113 pounds.

"Difficulties were so great and the hardship

so enormous," Luo said. "It was a terrible job."

Luo had crossed back and forth over Maan Shan, the point I had hoped to reach. In winter the snow was three feet deep and six-foot icicles hung from the rocks. He said the last time someone had crossed the pass was in 1966, so he doubted whether I would be able to do it.

But I did get a glimmer of what it must have been like to travel the road. In Xinkaitian, the first stop on the tea porters' 20-day trek from Yaan to Kangding, clean-shaven Gan Shao Yu, 87, and bristle-faced Li Wen Liang, 78, insisted on acting out their lives as porters.

Backs bent beneath immense, imaginary

Mark Jenkins reported on the Chinese city of Shangri-La in May 2009. Michael Yamashita's photographs of Jiuzhaigou Nature Reserve appeared in March 2009.



As many as 25,000 Tibetan horses a year were traded to China for use in the imperial cavalry or as pack animals.

Tea Horse Road

The Chinese military's need for horses and Tibet's appetite for tea created a trade network in the 11th century spanning the Tibetan Plateau. Opening China's western frontier, the Chamagudao (Mandarin for "tea-horse caravan route") lasted until the 1950s.

MARTIN GAMACHE, MARGUERITE B. HUNSIKER, NGM STAFF
 ART: FERNANDO G. BAPTISTA, NGM STAFF; MIKE REAGAN
 SOURCES: GECKO MAPS; PATRICK BOOZ; JEFF FUCHS



100°E

30°N

25°

QINGHAI ROUTE

SICHUAN

SICHUAN TEA-GROWING AREA

The rugged northern route began in Sichuan Province and extended west for almost 1,400 miles.

CHINA

Main branches of the Sichuan-Tibet tea-horse trade route network

- Pack animal section
- Porter section
- Other road
- Buddhist monastery

YUNNAN ROUTES

YUNNAN

YUNNAN TEA-GROWING AREA

Tea traveled the southern route from Yunnan Province as early as the seventh century, and later included Puer tea, which was especially popular in monasteries.

MYANMAR (BURMA)

VIETNAM

LAOS

Trade items from China also included silks, ceramics, metal goods, and guns. From Tibet came wool, musk, and medicinals.

XIXUANGBANNA

GUIZHOU

Zar Gama Pass
15,282 ft
4,658 m

Zheduo Pass
16,168 ft
4,928 m

Hengduan Mountains

SICHUAN

Sersshul

Jomda

Qamdo

Batang

Zogang

Markam

Deqen

Xiangcheng

Shangri-La

Dali

Songpan

SHECHEN

Dege

Rongbatsa

Ganze

Luhuo

Dawu

Danba

GARTHAR

Bamei

Kangding

Changheba

Xinkaitian

MINGSHAN TEA PLANTATION

Yaan

Yingjing

Hanyuan (Fulin)

Maan Shan Pass

Luding

Xinduqiao

Yajiang

Litang

Myitkyina

Tengchong

Kunming

Puer

Simao

Yiwu

loads of brick tea, veiny hands on T-shaped crutches, heads down and eyes on their splayed feet, the two old men showed me how they wobbled single file along a wet stretch of cobblestone. After seven steps Gan stopped and stamped his crutch three times, following tradition. Both men circled their crutches around to their backs to rest their wood-frame packs atop the crutch. Wiping sweat from their brows with phantom bamboo whisks, they croaked out the tea porter song:

Seven steps up, you have to rest.

Eight steps down, you have to rest.

Eleven steps flat, you have to rest.

You are stupid, if you don't rest.

Tea porters, both men and women, regularly carried loads weighing 150 to 200 pounds; the strongest men could carry 300. The more you carried, the more you were paid: Every pound of tea was worth a pound of rice when you got back home. Wearing rags and straw sandals, porters used crude iron crampons for the snowy passes. Their only food was a satchel of corn bread and an occasional bowl of bean curd.

"Of course some of us died on the way," Gan said solemnly, his eyelids half shut. "If you got caught in a snowstorm, you died. If you fell off the trail, you died."

Tea portering ended soon after Mao took over the country in 1949 and a highway was built. Redistributing land from the wealthy to the poor, Mao released the tea porters from servitude. "It was the happiest day of my life," Luo said. After he received his parcel of land, he began to grow his own rice and "that sad period passed away."

TEA WAS FIRST BROUGHT TO TIBET, legend has it, when Tang dynasty Princess Wen Cheng married Tibetan King Songtsen Gampo in A.D. 641. Tibetan royalty and nomads alike took to tea for good reasons. It was a hot beverage in a cold climate where the only other options were snowmelt, yak or goat milk, barley milk, or chang (barley beer). A cup of yak butter tea—with its distinctive salty, slightly oily, sharp taste—provided a mini-meal for herders

warming themselves over yak dung fires in a windswept hinterland.

The tea that traveled to Tibet along the Tea Horse Road was the crudest form of the beverage. Tea is made from *Camellia sinensis*, a subtropical evergreen shrub. But while green tea is made from unoxidized buds and leaves, brick tea bound for Tibet, to this day, is made from the plant's large tough leaves, twigs, and stems. It is the most bitter and least smooth of all teas. After several cycles of steaming and drying, the tea is mixed with gluey rice water, pressed into molds, and dried. Bricks of black tea weigh from one to six pounds and are still sold throughout modern Tibet.

By the 11th century, brick tea had become the coin of the realm. The Song dynasty used it to buy sturdy steeds from Tibet to take into battle against fierce nomadic tribes from the north, antecedents of Genghis Khan's hordes. It became the prime trading commodity between China and Tibet.

For 130 pounds of brick tea, the Chinese would get a single horse. That was the rate set by the Sichuan Tea and Horse Agency, established in 1074. Porters carried tea from factories and plantations around Yaan up to Kangding, elevation 8,400 feet. There tea was sewn into waterproof yak-skin cases and loaded onto mule and yak trains for a three-month journey to Lhasa.

By the 13th century China was trading millions of pounds of tea for some 25,000 horses a year. But even all the king's horses couldn't save the Song dynasty, which fell to Genghis's grandson, Kublai Khan, in 1279.

Nonetheless, bartering tea for horses continued through the Ming dynasty (1368-1644) and into the middle of the Qing dynasty (1645-1912). When China's need for horses began to wane in the 18th century, tea was traded for other goods: hides from the high plains, wool, gold, and silver, and, most important, traditional Chinese medicinals that thrived only in Tibet. These are the commodities that the last of the tea porters, like Luo, Gan, and Li, carried back from Kangding after dropping off their loads of brick tea.



Tea travels the old way, by foot, as a nomad heads back to camp carting two bundles purchased in the Sichuan market town of Ganze. A bundle holds four bricks, more than 20 pounds of tea. Given Tibetans' consumption—drinking up to 40 cups a day—that is barely enough tea to last a month.

Just as China's imperial government used to regulate the tea trade in Sichuan, so monasteries influenced the trade in theocratic Tibet. The Tea Horse Road, known to Tibetans as the Gyalam, connected the important monasteries. Over the centuries, power struggles in Tibet and China changed the Gyalam's route. There were three main trunk lines: one from the south in Yunnan, home of Puer tea; one from the north; and one from the east cutting through the middle of Tibet. Because it was the shortest, this center route handled most of the tea.

Today the northern route, Highway 317, is blacktop. Near Lhasa it parallels the Qinghai-Tibet railway, highest in the world. The southern route, Highway 318, is also oiled. These highways are major arteries of commerce, clogged with trucks carrying every imaginable commodity from tea to school tablets, solar panels to

plastic plates, computers to cell phones. Almost all of it goes one way—west to Tibet, to meet the needs of a ballooning Chinese population.

The western half of the middle route has never been paved. This is the segment that winds through Tibet's remote Nyainqentanglha Mountains, an area so rugged and inhospitable it was simply abandoned decades ago and the entire area closed to travelers.

I'd seen what was left of the original trail in China. To do the same in Tibet, I'd have to find a way into these forbidden mountains. I called my wife, Sue Ibarra, who is an experienced mountaineer, and asked her to meet me in Lhasa in August.

WE BEGIN OUR JOURNEY at the Drepung monastery, which lies at the western end of the Tea Horse Road—less than a day's horse ride from



At harvesttime in Yiwu in southern Yunnan, a farmer is busy with both family and setting out leaves to dry. From this area comes Puer tea, prized for its earthy taste and perceived medicinal benefits. A cup in distant Beijing may cost ten dollars or more.





Lhasa. Built in 1416, it has a cavernous tea kitchen, or *gyakhang*. Seven iron cauldrons from six to ten feet in diameter are imbedded in a gargantuan, wood-fired, stone hearth.

Standing above a cauldron, Phuntsok Drakpa cleaves off tome-size slabs of yak butter into the steaming tea. "There were once 7,700 monks here who drank tea twice a day," he says. "More than a hundred monks worked in this tea kitchen." Swathed in a sleeveless maroon robe, Drakpa has been the tea master in the monastery for 14 years. "To Tibetan monks," he says, "tea is life."

Today only 400 monks reside in the monastery, and only two small cauldrons are in use. "For one little cauldron, 25 bricks of tea, 70 kilos of yak butter, 3 kilos of salt," says Drakpa, stirring this recipe for 200 with a wooden spoon tall as a human. "For the biggest cauldron, we used seven times that much."

From the monastery, Sue and I set out for the city of Nagqu, a five-hour drive north from Lhasa, to attend the annual horse festival. We want to see the legendary horses that gave their name to the Tea Horse Road. The weeklong event used to be held on the open plains, but ten years ago a concrete stadium was built so Chinese officials would have someplace to sit. When we arrive the next morning, Tibetans pack the stands: women with high cheekbones, high heels, and long braids heavy with silver and amber; men in felt cowboy hats and the long-sleeved coats they call *chubas*; sockless kids in cheap sneakers. Hawkers sell spicy boiled potatoes and cans of Budweiser. Blaring speakers announce each event in Tibetan and Chinese. It's a rodeo atmosphere, except for the Chinese policemen stationed every ten yards along the bleachers, marching in squadrons around the field, and lurking in plainclothes.



The smoky whiff of black tea mixed with the aroma of yak butter candles pervades Tibetan monasteries, where monks for centuries have consumed the beverage to stay awake for meditation. At the Ganze monastery (left), the morning ritual involves cooking and ladling tea for 370. In Garthar, guests bring their bowls to the prayer hall (above) for a welcoming pour.

Down on the field, horse and rider seem to defy gravity. A contestant gallops almost out of control, dangling like an acrobat off the side to pluck a white silk scarf from the ground. Clods of mud propel into the sharp blue sky. Holding the scarf aloft, the Tibetan cowboy wheels his rearing horse to the roar of the crowd.

The Nagqu Horse Festival is one of the few surviving events celebrating Tibet's equestrian heritage. Through centuries of selective breeding, Tibetans created a premium horse called the Nangchen. Standing only 13.5 hands high (about 4.5 feet—smaller than most American breeds), fine-limbed and handsome-faced, with enlarged lungs adapted to life on the 15,000-foot-high,

oxygen-starved Tibetan Plateau, Nangchen steeds were bred to be inexhaustible and sure-footed on snowy passes. These were the horses coveted by the Chinese centuries ago.

Today Nagqu sits on modern Highway 317, the northern branch of the Tea Horse Road. All signs of the former trade route have vanished, but just a day's drive southeast, temptingly close, are the Nyainqentanglha Mountains, where the original trail once passed. I am captivated by the possibility that back in the deep valleys Tibetans might still ride their indefatigable horses along the original trail. Perhaps, hidden in the vast hinterland, there is even still trade along the road. Then again, maybe the trail has vanished



Two riders on horses are shown in the foreground, wearing traditional, colorful costumes. The rider on the left is wearing a white shirt and a yellow and red headpiece. The rider on the right is wearing a bright orange and red outfit and a large, ornate headdress. They are riding on a dirt track, and a crowd of spectators is visible in the background. The scene is set outdoors, likely at a festival or competition.





as it did in Sichuan, wiped out by howling wind and tumbling snow.

One rainy black morning halfway through the festival, while the police are looking the other way, Sue and I slip off in a Land Cruiser to find out what has happened to Tibet's Tea Horse Road. We race all day on dirt roads, grinding over passes, almost rolling on steep slopes. We don't stop at checkpoints, and we creep right past village police stations. By nightfall we reach Lharigo, a village between two enormous passes that once served as a sanctuary along the Gyalam. Surreptitiously, we go door-to-door looking for horses to take us up to 17,756-foot Nubgang Pass. There are none to be found, and we're directed to a saloon on the edge of town. Inside, Tibetan cowboys are drinking beer, shooting pool, and placing bets on a dice game called *sho*. They laugh when we ask for horses. No one rides horses anymore.

Outside the saloon, instead of steeds of muscle standing in the mud, there are steeds of steel: tough little Chinese motorcycles decorated like their bone-and-blood predecessors—red-and-blue Tibetan wool rugs cover the saddles, tassels dangle from the handlebars. For a price, two cowboys offer to take us to the base of the pass; from there we must walk.

We set off in the dark the next morning, backpacks strapped to the bikes like saddlebags. The cowboys are as adept on motorbikes as their ancestors were on horseback. We bounce through black bogs where the mud is two feet deep, splash through blue braided streams where our mufflers burble in the water.

Up the valley we pass the black tents of Tibetan nomads. Parked in front of many of the yak hair tents are big Chinese trucks or Land Cruisers. Where did nomads get the money to buy such vehicles? Certainly not from the



Modern workhorses, Chinese-made motorcycles line a street in Sershul. Many belong to nomads who come to sell yartsa gompo—dried, fungus-infected caterpillars—marketed as a medicinal cure-all. Dug from high-altitude grasslands, a handful of “worm grass” (left) may sell for thousands of dollars, bringing much needed cash to rural families.

traditional yak meat-and-butter economy.

It takes five hours to cover the 18 miles to Tsa-chuka, a nomad camp at the base of the Nubgang Pass. The ride thoroughly jars our spines. The cowboys build a small sagebrush campfire and, after a lunch of yak jerky and yak butter tea, Sue and I set off on foot for the legendary pass.

To our delight, the ancient path is quite visible, like a rocky trail in the Alps, winding up meadows speckled with black, long-horned yaks. After two hours of hard uphill hiking, we pass two shimmering sapphire tarns. Beyond these lakes, all green disappears and everything turns to stone and sky. Mule trains of tea stopped crossing this pass over a half century ago,

but the trail had been maintained for a thousand years, boulders moved and stone steps built, and it's all still here. Sue and I zigzag through the talus, along the walled path, right up to the pass.

The saddle-shaped Nubgang Pass has clearly been abandoned. The few prayer flags still flapping are worn thin, the bones atop the cairns bleached white. There is a silence that only absence can create. Sue stares at the snowcapped peaks surrounding us, raw gray pyramids. Over centuries, only a few Westerners have ever stood here. I catch Sue's eyes following the enduring trail down into the next valley.

“Can you see it?” she asks.

I can. In my imagination I see a mule train of





The Potala Palace, former residence of the Dalai Lama, commanded the view as caravans neared Tibet's capital of Lhasa. In the 18th and 19th centuries, the 13-story structure ranked among the world's tallest buildings.



a hundred animals plodding up toward us, dust swirling around their hooves, loads of tea rocking side to side, the cowboys alert for bandits waiting in ambush on the Nubgang Pass.

Our motocowboys are waiting for us the next morning when we return from the pass. We saddle up and begin the long ride out, bumping and bashing down glacial valleys.

At midday we stop at two black nomad tents,

surrounded by neat stacks of yak dung. A large solar panel hangs on each tent, and parked in the grass are a truck, a Land Cruiser, and two motorcycles. The nomads invite us in and offer cups of scalding yak butter tea.

Inside the tent, an old woman is twirling a prayer wheel and mumbling mantras, a young man is cooking in a shaft of light, and a few middle-aged men are sitting on thick Tibetan



rugs. Through sign language and a pocket dictionary, I ask the men how they can afford their vehicles. They grin wildly, but the conversation strays. After we've finished heaping bowls of rice with greens and hunks of yak meat, the head of the household pulls out a blue metal box, unlocks it, pries open the lid, and motions for us to have a look.

Inside are hundreds of dead caterpillars.

On their way to Lhasa, pilgrims prostrate themselves every three steps. Having spent weeks on foot, the family still has nearly 300 miles to go on this thousand-year-old road.

"Yartsa gompo," our host says proudly. Each dried caterpillar, he explains, will sell for between four and ten dollars. There's probably ten grand in dead caterpillars in his padlocked blue box. Yartsa gompo—called *chong cao* in China—is a parasite-infected caterpillar that lives only in grasslands above 10,000 feet. The parasite, a kind of fungus, kills the caterpillar, then feeds on its body.

Every spring Tibetan nomads wander their yak meadows with a small, curved metal trowel looking for the caterpillars. Poking up less than an inch, the purplish, toothpick-shaped yartsa gompo stem is extremely difficult to spot—but the caterpillars are worth more than all their yaks combined.

In Chinese medicine shops throughout Asia, *chong cao* is sold as a cure-all for the ravages of aging, for health issues ranging from infection to inflammation, fatigue to phlegm to cancer. Displayed in climate-controlled glass cases, the highest quality caterpillars sell for nearly \$80 a gram, which is about twice the price of today's gold. The Tibetan closes his treasure box and tucks it into the side of his tent. Before we depart, he insists we have one more cup of burning yak butter tea.

As we ride off across the high plains, I am struck by the irony of this new commerce along the old Tea Horse Road. Tibetans no longer ride horses, and tea is no longer the primary drink in urban Tibet (Red Bull and Budweiser are everywhere). And yet, just as tea still comes from traditional regions of China, *chong cao* can be found only on the Tibetan Plateau. Shoes and shampoos, TVs and toasters may be pouring westward along the paved portions of the ancient trade route, but something is going back east. Today the Chinese are willing to pay as dearly for magic caterpillars as they once did for invincible horses. □

Kuhmo, Finland

Standing his ground, a Eurasian brown bear play-fights with his mother in remote woodlands along Finland's border with Russia. Across Europe, big bruins and other wildlife are making a comeback.

STAFFAN WIDSTRAND, *URSUS ARCTOS*



A misty forest scene with tall trees and a stream in the foreground. The trees are mostly bare, with some green leaves still on the branches. The stream is in the foreground, and the background is a soft, hazy green. The overall mood is serene and quiet.

Europe's Wild Side

A dream team of European photographers captures the continent's wildlife and landscapes.



Mont Blanc, France

Dwarfed by Mont Blanc and a glacial lake, an alpine ibex (above, left) pauses on its journey back from the brink. Down to fewer than a hundred animals in the 1800s, ibex now number 40,000, thanks to aggressive reintroduction.



69 photographers,

46 countries, 15 months, one mission: to celebrate wildlife and wild places on a continent more famous for monuments to human ingenuity—cities, railways, cafés—than for nature preservation. Yet as Staffan Widstrand, one of the project’s directors, observes, “Wildlife is coming back because of changes in policy and lifestyles. Almost 20 percent of Europe is now under some form of protection, and there’s a huge shift under way as Europeans abandon family farms for cities. So wildlife is actually gaining ground and becoming a more vital part of the European experience.” This sampling of photographs proves his point. Along with thousands of others, they are the culmination of Wild Wonders of Europe, a photographic expedition to the wild heart of a civilized continent. —Don Belt

Society Grant This project was supported by members of the National Geographic Society through its Mission Programs. Learn more, and view additional photographs, at ngm.com and wild-wonders.com.



NGM MAPS

Europe's Wild Wonders

Fanning out across Europe, the project's photographers carried out 125 missions in a variety of ecosystems, from marine environments in the Azores to forested steppes along the Caspian Sea. What they found was a continent in transition: While urban and suburban growth swallow up wild habitat, farmland in less fertile regions is returning to forest, giving wildlife new room to roam. Expect this trend to continue through mid-century, says ecologist Magnus Sylven, former director of Europe programs for the World Wildlife Fund. "As we abandon the countryside, plants and animals will simply take our place. There's no vacuum in nature."



Oulu, Finland



Azores, Portugal

Long on charisma, short on habitat, the great gray owl was once so feared as an evil omen that it was shot on sight. Now protected, it is reclaiming lost territory and thriving on voles, mice, and other small mammals.

Trailed by pilotfish, a young loggerhead cruises Atlantic waters around the Azores, where all sea turtles are protected by the EU. Juveniles typically reside within 15 feet of the surface, where waters are warm.



Saltee Islands, Ireland

The northern gannet spends most of its life at sea, plunging into the water for prey. But during the summer breeding season, the migratory birds pause to colonize rocky outcrops.

PALAEOMANUS BOVIANUS





Madeira Islands, Portugal



Gibraltar, United Kingdom

Once common in the Mediterranean, the monk seal (top) is now the world's most endangered seal species. In the protected waters of the Madeira Islands, its population has increased from six to 35 individuals since the late

1980s. Transplants from North Africa, Barbary macaques (above) have colonized the Rock of Gibraltar for hundreds, perhaps thousands, of years. Besides humans, macaques are the only European primates.



Oostvaardersplassen, Netherlands



Kalmykiya, Russia

Herds of red deer (top), abundant in primeval Europe, range free at Oostvaardersplassen, a 14,000-acre preserve where Dutch ecologists nurture a mixed landscape of forest and heavily grazed grasslands.

Stretching stubby wings, steppe eagle chicks share a nest at Cherniye Zemliye reserve. Ranging from southern Russia to Mongolia, these birds are born opportunists, feeding on carrion, small mammals, and other birds.



Kemeri, Latvia

Left behind when the Baltic receded millennia ago, the bogs, fens, and meadows of Kemeri National Park are part of the European Union's Natura 2000 network, which protects 27,000 sites.





Inverness, United Kingdom



Donna Nook, United Kingdom

Losing ground and numbers, Europe's native red squirrel (top) is poorly matched against *Sciurus carolinensis*, an invader from North America that muscled in on food supplies and carries a virus lethal to reds. Kicking up

sand, male gray seals (above) fight over females at Donna Nook on the English coast, where a Royal Air Force bombing range doubles as a nature preserve, home to a breeding population of 2,000 seals.



Białowieża, Poland



Gran Paradiso, Italy

In Europe's wild east, conservationists reintroduced the iconic European bison (top) to Poland's Białowieża Forest in 1952, bringing back an animal that had once inhabited the continent's woodlands. Cousin to both

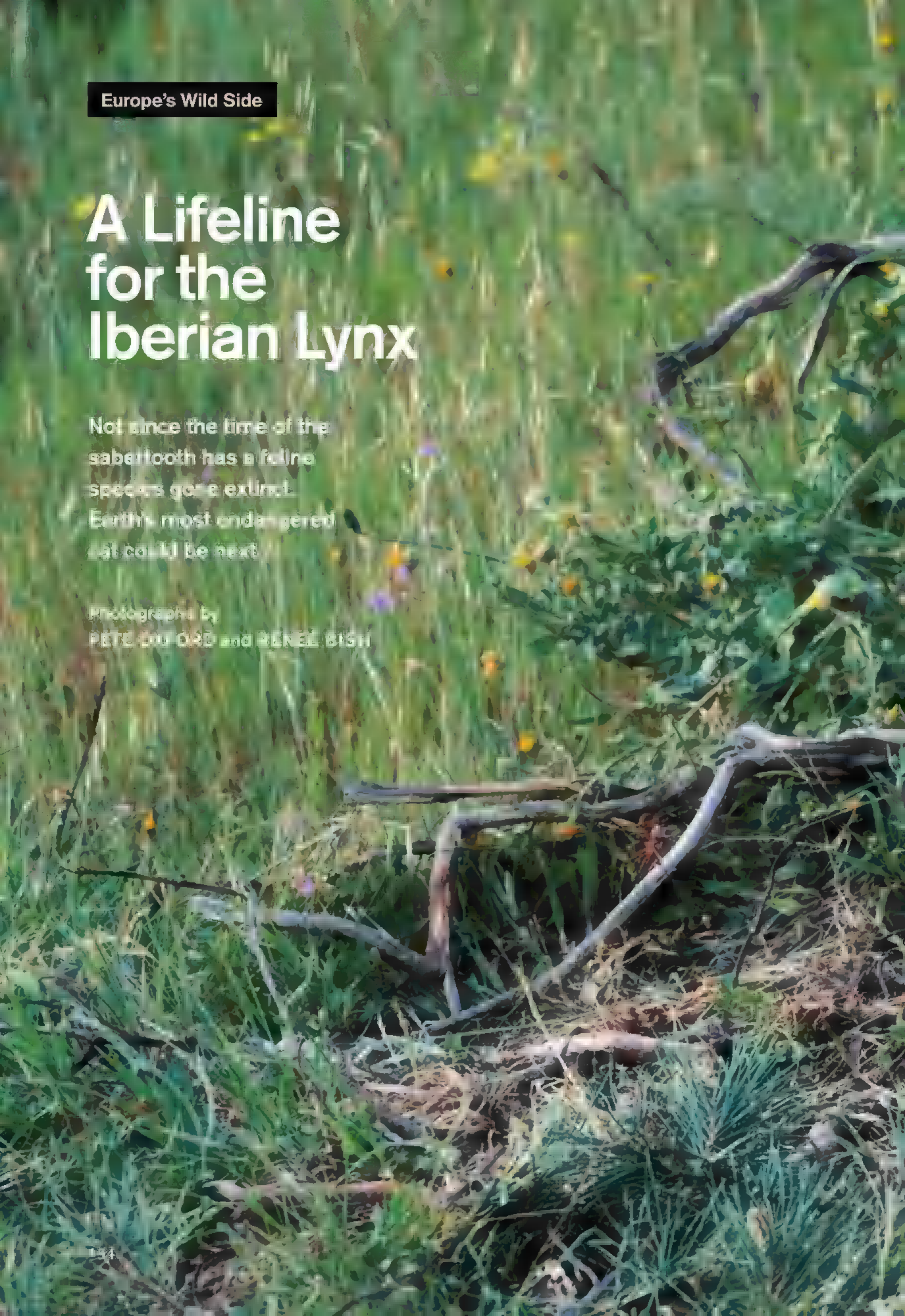
antelope and mountain goat, a chamois (above) cruises a snowfield in the Italian Alps. As Europeans abandon farming for other livelihoods and the countryside for cities, wildlife is reclaiming lost territory.

Europe's Wild Side

A Lifeline for the Iberian Lynx

Not since the time of the
sabertooth has a feline
species gone extinct.
Earth's most endangered
cat could be next.

Photographs by
PETE COFFORD and RENEE BISH



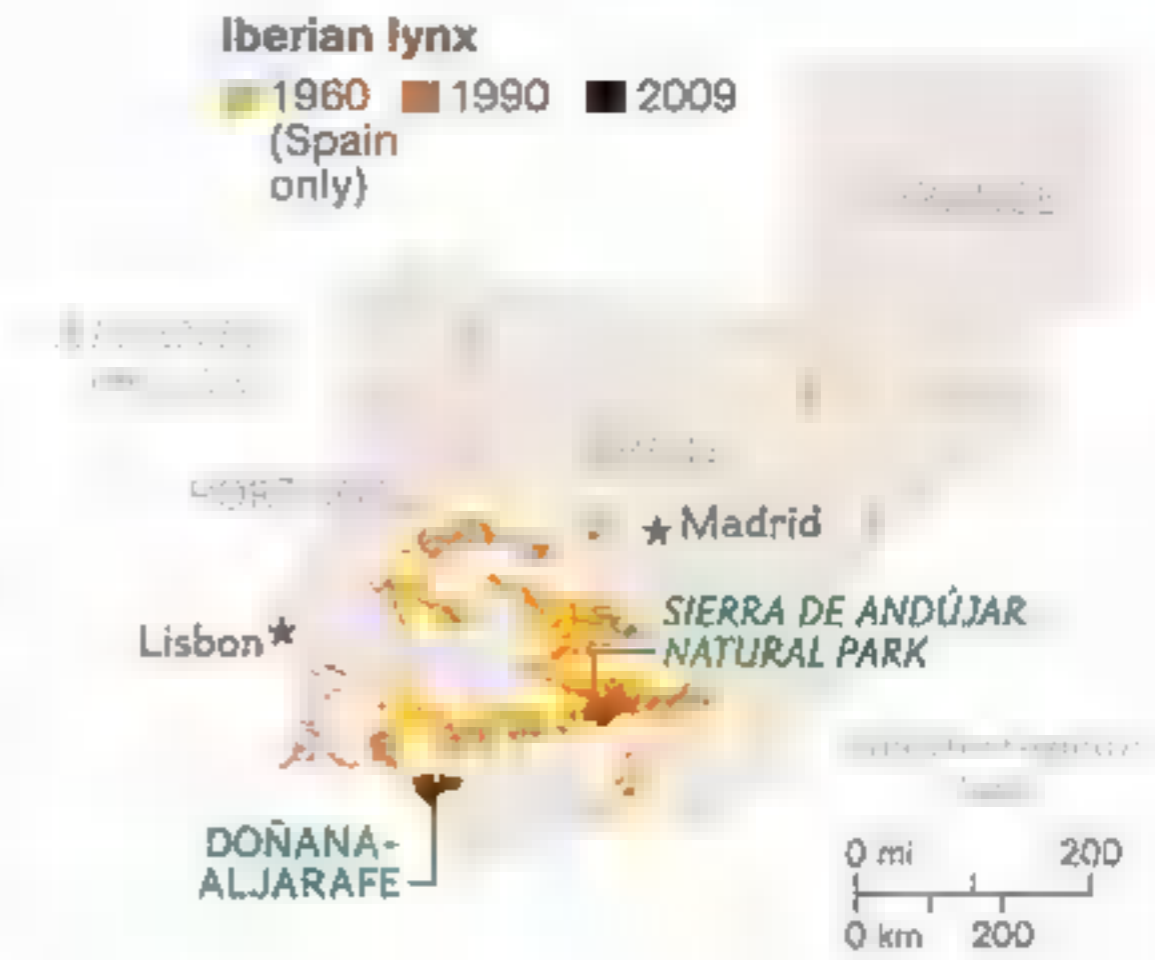




Spring-footed Elanio, a 4-year-old male in Spain's Sierra de Andajar Natural Park, clears a "predator-proof" fence—just what wildlife managers intended. Designed to thwart other rabbit-eaters like fox and boar while letting cats up and over, the fence surrounds a feeding area seeded with prey. Offering extra food is extreme but, right now, crucial. Lynx simply won't breed if rabbits are scarce. And while one rabbit a day feeds a single lynx, a mother (right) with cubs needs two or three.



Its golden eyes have shone across Mediterranean lands for ■ million years. But the 25-pound Iberian lynx, icon of Spain and Portugal, is on shaky turf. Its wild count is about 225 animals, up from 100 a decade ago but far too low for long-term survival. Hunting, road kills, and habitat loss have sped the plunge of *Lynx pardinus*, as has near-total dietary reliance on rabbits—themselves overhunted and slammed by disease. Only two breeding populations remain, based in protected areas in Spain (map). With pledges of \$35 million for conservation, the Lynx Life group is boosting rabbit numbers, moving cats to underused haunts, and safeguarding prey-friendly habitat. In the near future, it hopes to release captive-bred lynx into the wild. For now, says Lynx Life director Miguel Angel Simón, improving life for wild lynx on wild land is the best strategy. —Jennifer S. Holland



MAP: LISA ■ RITTER, NGM STAFF
SOURCE: LYNX LIFE NATURE, ANDALUSIA



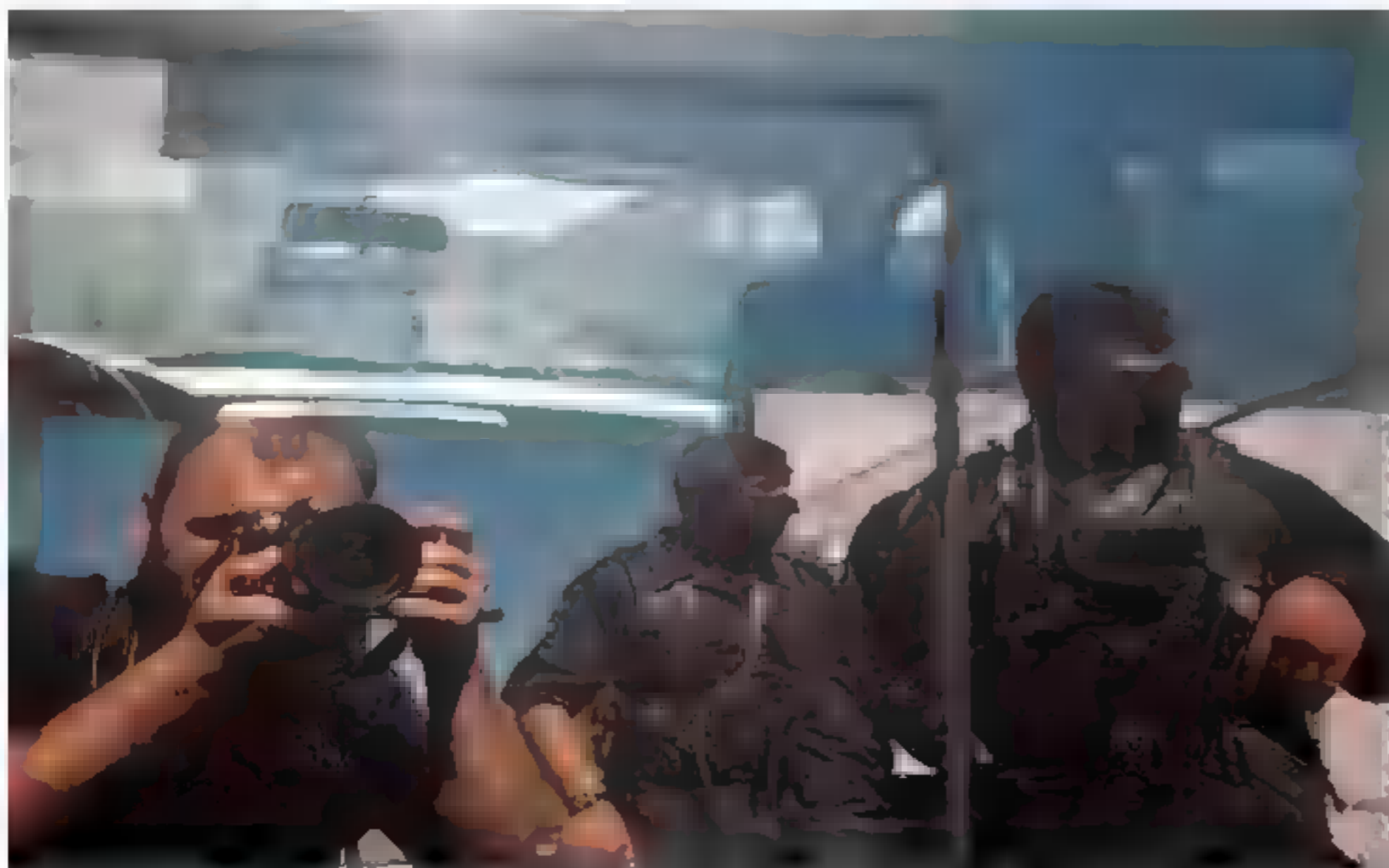


His mother, Rappas (above and left), is still in charge for now, but Elanio will soon strike out and seek his own territory in the region's forest, thicket, and scrub. A radio collar will enable staff of Lynx Life, a Spanish conservation group, to monitor him. Lynx tend to be solitary after their first year and have been reported to stick to narrow ranges of about ten square miles—and to shun farmed or developed landscapes. But last year Lynx Life staff tracked a female on a nearly 200-mile foray. She successfully hunted on agricultural land—a hopeful sign of adaptability for this most critically endangered of cats.

Pete Oxford and Reneé Bish photographed the Iberian lynx while on assignment for Wild Wonders of Europe.



ON ASSIGNMENT Wild Moment Great gray owls aren't known for being shy. Sven Zacek learned just how bold the birds can be while on assignment in Finland's snowy Oulu region. Instead of choosing to rest in a distant spruce tree, this female settled atop the photographer's tripod, set up 40 feet from where Zacek stood. With another camera, he caught the bird's confident landing.



ON ASSIGNMENT Prison Patrol Outside the Center for Enforcement of the Legal Consequences of Crime, Shaul Schwarz (above, at left) rode around in the back of a pickup truck with two anonymous guards. "It was hard to get access with a camera," explains the Israeli photographer, who covered this month's story on Mexican cults. The day before, Schwarz had been allowed into the prison, but only for two hours. "This is a hard-core jail," he says, adding that trust was an issue throughout the assignment. "Everybody is masked, and not knowing who is who is very scary."

Society Updates



SPECIAL ISSUE

Nature's Fury portrays the power of forces shaping our planet. The 100-page special issue includes coverage of the earthquake in Haiti. Go to ngm.com/natures-fury.

NG CHANNEL

The universe's most outrageous storms churn in outer space. What would happen if this wild weather hit Earth? Scientists find out in *Storm Worlds*, a three-part special debuting May 16 at 8 p.m. on the National Geographic Channel.

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BIOBLITZ

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GeoPuzzle Answers

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How Has Christianity Changed over 2,000 Years?

In the first centuries after Christ, there was no “official” New Testament. Instead, early Christians read and fervently followed a wide variety of scriptures—many more than we have today.

Relying on these writings, Christians held beliefs that today would be considered bizarre. Some believed that there were 2, 12, or as many as 30 gods. Some thought that a malicious deity, rather than the true God, created the world. Some maintained that Christ’s death and resurrection had nothing to do with salvation while others insisted that Christ never really died at all.

What did these “other” scriptures say? Do they exist today? How could such outlandish ideas ever be considered Christian? If such beliefs were once common, why do they no longer exist? These are just a few of the many provocative questions that arise from **Lost Christianities: Christian Scriptures and the Battles over Authentication**, an insightful 24-lecture course taught by Professor Bart D. Ehrman, the Chair of the Department of Religious Studies at the University of North Carolina at Chapel Hill and the author and editor of 17 books, including *The New York Times* bestseller *Misquoting Jesus*.

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Deep Sleep In October 1940—as German bombs rained on their city—Londoners sought overnight safety in the Aldwych tube station, one of about 80 underground stops used as shelters during World War II. At times more than 170,000 people slept in the shelters. At first the station staff were unprepared, says Robert Bird, senior curator of the London Transport Museum. “Gradually, sheltering became properly organized, with admission tickets, bunk beds, medical aid, chemical toilets, and refreshments.” These days nobody sleeps at Aldwych—not even on a train car passing through. The station was permanently closed to traffic in September 1994. —Margaret G. Zackowitz

👉 **Flashback Archive** Find all the photos at ngm.com.

PHOTO: ACME NEWSPICTURES/NATIONAL GEOGRAPHIC STOCK

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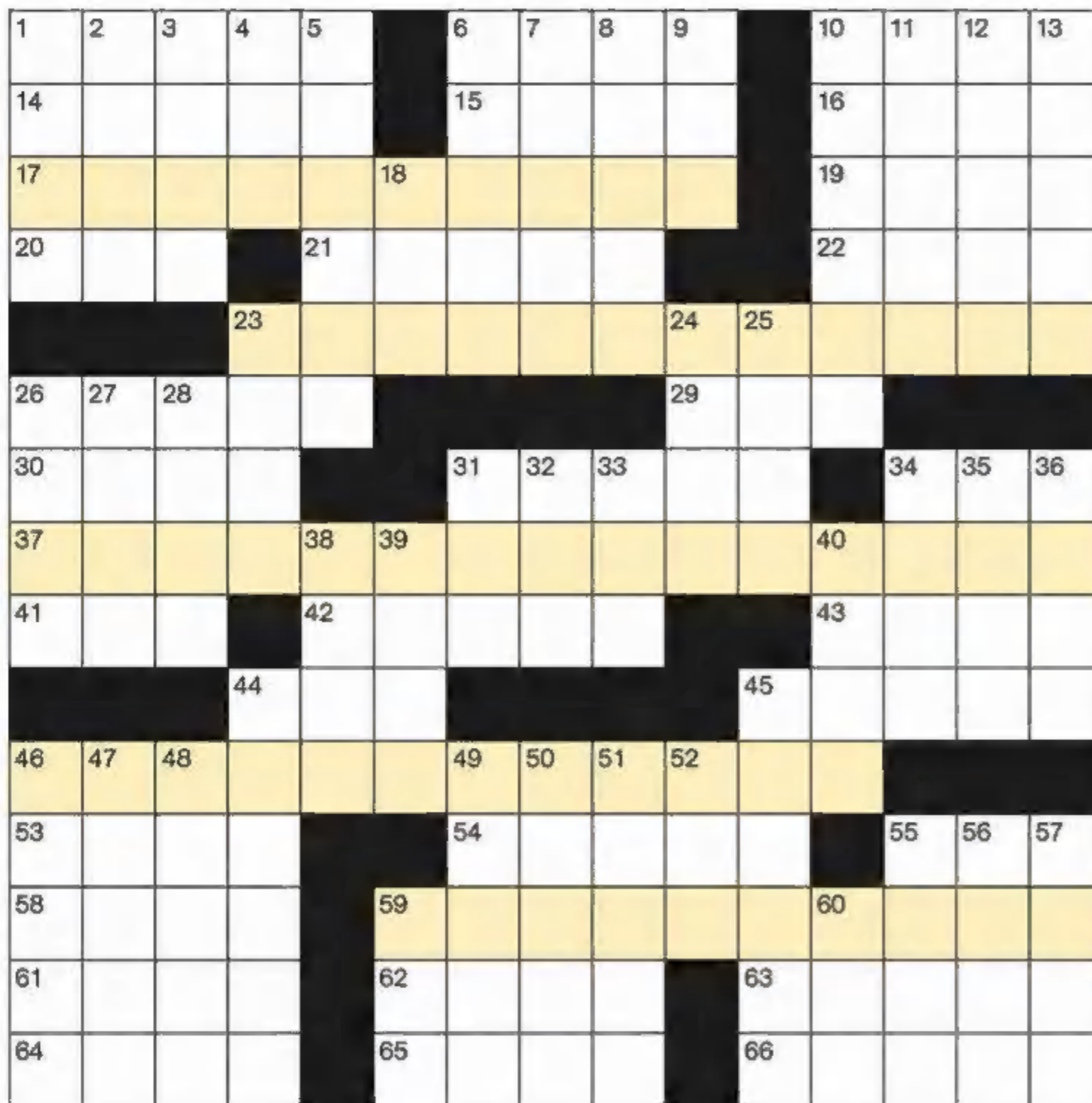
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GEOPUZZLE



DOWN

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- 3 Russian-Chinese border river
- 4 Pince-___ (lorgnette alternative)
- 5 Handy contrivances
- 6 Ladybug's tidbit
- 7 Mooring site
- 8 Book, to Brutus
- 9 Source of fed. aid for some seniors
- 10 Medium of "The Thinker"
- 11 Pulled through
- 12 One of Florida's national forests
- 13 Word with pot or beer
- 18 Rooster's syllable
- 23 Sax player Stan
- 24 Prefix meaning "peculiar"
- 25 New Mexico Pueblo tribe
- 26 Abandoned
- 27 Dog drawn by Jim Davis
- 28 Sphinx and Great Pyramid site
- 31 Palindromic explosive
- 32 As it increases, sleep may decrease
- 33 Sleepwear, for short
- 34 Pertaining to 55 Across
- 35 "Hawkeye" Pierce portrayer
- 36 *Kate and Leopold* star Meg
- 38 Baroness's title
- 39 Start of a wedding pronouncement
- 40 Vietnam port, Da ___
- 44 They fell under Cortés
- 45 Toward the center
- 46 Indiana not seen on maps?
- 47 Love, in Lido
- 48 "Shut your trap!"
- 49 Get guffawing
- 50 2002 Minnelli album, "___ Back"
- 51 Jug band instrument that adds a buzz
- 52 British dependency in the Irish Sea: abbr.
- 55 Raw silk color
- 56 Biblical husband of Jezebel
- 57 Littlest littermate
- 59 Short tale?
- 60 Start to -phyte



Get Some Sleep

Puzzle by Cathy Allis

Scientists are continually looking into the mysteries of sleep. Three-month-old Sarah Alexandra James (left) was part of a study at the sleep labs of the Sleep and Performance Research Center in Spokane, Washington. (She slept right through it.) This month's GeoPuzzle presents its own sleep-related challenge: Can you solve the themed answers below without following the command in clue number one?

ACROSS

- 1 "Saw wood," for instance
- 6 Punches with points
- 10 Amorphous mass
- 14 Oscar-winning actress in *My Cousin Vinny*
- 15 Greek consonants
- 16 Crunchy kind of cake
- 17 Noisy Mideast capital?
- 19 Like many a face
- 20 Cardinals : STL :: Blue Jays : ___
- 21 Wavy-patterned fabric
- 22 *The Old Curiosity Shop* girl
- 23 Period when one's hair isn't too out of control?
- 26 Theater sections
- 29 Exactly, in compass readings
- 30 Mark up, in a way
- 31 Easy putt
- 34 It's used in a scull operation
- 37 Like a couple whose marriage is on the rocks, come April 15th?
- 41 Chai, e.g.
- 42 Kitty's fill
- 43 Opera that opens in Memphis
- 44 Brouhaha
- 45 Machu Picchu dweller
- 46 Legal but flamboyant street practice?
- 53 Leave unsaid
- 54 Siamese "Please!": var.
- 55 Hammer-and-anvil site
- 58 Opposite of "yep"
- 59 Downy mustache style?
- 61 Explorer Leif's father: var.
- 62 Golf Hall of Famer Aoki
- 63 Had additional airings
- 64 Layettes, e.g.
- 65 Señorita's kiss
- 66 Have reservations

Answers in
Inside Geographic

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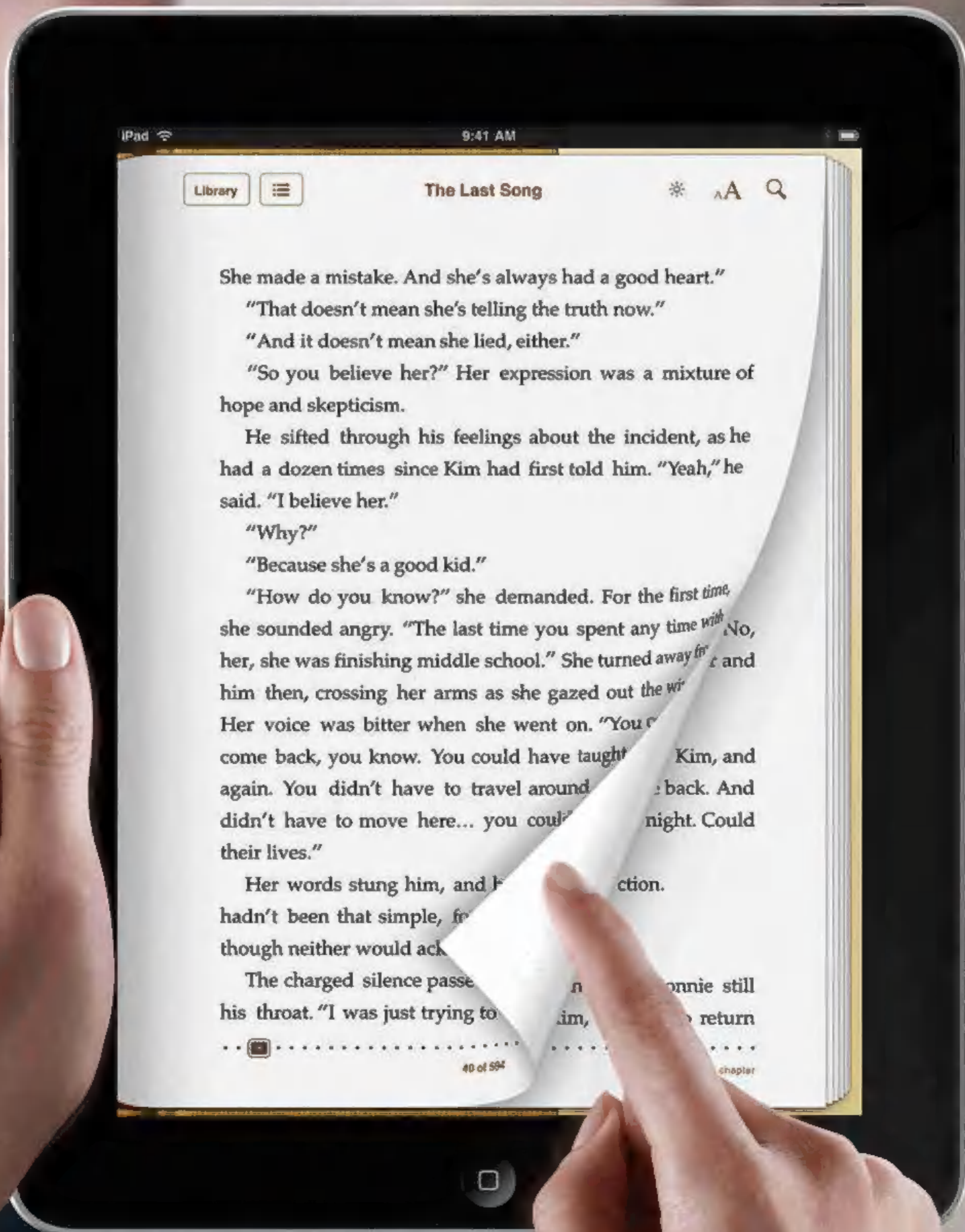
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She made a mistake. And she's always had a good heart."
"That doesn't mean she's telling the truth now."
"And it doesn't mean she lied, either."
"So you believe her?" Her expression was a mixture of hope and skepticism.

He sifted through his feelings about the incident, as he had a dozen times since Kim had first told him. "Yeah," he said. "I believe her."

"Why?"
"Because she's a good kid."
"How do you know?" she demanded. For the first time, she sounded angry. "The last time you spent any time with her, she was finishing middle school." She turned away from him then, crossing her arms as she gazed out the window. Her voice was bitter when she went on. "You could have come back, you know. You could have taught Kim, and again. You didn't have to travel around the world and didn't have to move here... you could have stayed the night. Could their lives."

Her words stung him, and he felt a sharp pain in his chest. It hadn't been that simple, for he knew she was right, though neither would acknowledge it.

The charged silence passed between them, and Ronnie still his throat. "I was just trying to help you, Kim, to return to your life."

.....
40 of 594 chapter